CHAPTER 3

TA-18 Relocation Project Alternatives

3. TA-18 RELOCATION PROJECT ALTERNATIVES

Chapter 3 begins with a description of the operations at TA-18 that are expected to continue regardless of the alternative the U.S. Department of Energy chooses. The chapter includes a description of the reasonable alternatives and the planning assumptions and bases for the environmental impact statement analyses. The alternatives considered and subsequently eliminated from detailed evaluation also are discussed. The chapter concludes with a summary comparison of the environmental impacts associated with the proposed action and the No Action Alternative and identifies the U.S. Department of Energy's Preferred Alternative.

3.1 PROJECT OPERATIONS AND REQUIREMENTS

The U.S. Department of Energy (DOE) intends to continue to perform current TA-18 mission operations. The mission operations, therefore, as well as the requirements to fulfill them at a new location, are those identified by current activities at TA-18 and are described below.

3.1.1 Operations

TA-18 personnel perform general-purpose nuclear materials handling, experiments, and training, including the construction and operation of high-multiplication devices, delayed critical devices, and prompt critical devices. The facilities at TA-18 are authorized to construct customized configurations of nuclear materials using security Category I special nuclear materials (SNM). These experiments and measurements are used primarily to test and qualify calculational methodology (integral nuclear cross sections and codes) and to develop, test, and qualify equipment and prototype devices. Training activities are conducted to develop and maintain capabilities and expertise within the nuclear materials handling community, including the capabilities and expertise of criticality safety engineers, emergency responders, and safeguards specialists.

The operational capabilities located at TA-18 enable DOE personnel to gain knowledge and expertise in advanced nuclear technologies that support the following areas (LANL 2000d):

- Nuclear Materials Management and Criticality Safety
- Emergency Response
- Nonproliferation and Safeguards and Arms Control
- Stewardship Science

Nuclear Materials Management and Criticality Safety

The objective of nuclear materials management and criticality safety activities is to ensure that fissile material is handled so that it remains subcritical under both normal and credible abnormal conditions to protect workers, the public, and the environment. This objective is relevant to all DOE programs that are responsible for safely managing SNM. A fully functional criticality safety program requires knowledgeable people and technical resources. The infrastructure that provides these two key elements needs to be maintained so that DOE can continue to work safely with fissile materials. The following activities would be required to support nuclear materials management and criticality safety:

- performance of experiments to support safety evaluations for nuclear material process operations
- testing and qualifying equipment and systems used to ensure nuclear criticality safety
- conducting experiments to better understand criticality impacts of nuclear materials in new physical situations
- maintaining the capability and expertise of DOE's nuclear criticality safety engineers and those who have criticality-safety-related responsibilities

Emergency Response

The Emergency Response Program elements conducted at TA-18 directly support initiatives flowing out of the President's declaration concerning weapons of mass destruction and the means of delivering them (Executive Order 12938). The Emergency Response Program is further defined by the development of Presidential Decision Directives 39 and 62. The program elements conducted at TA-18 ensure technologies to protect against technological surprise and diagnostic techniques to support and render-safe decisions. Additionally, the program maintains the personnel expertise resident at TA-18 and the infrastructure support methodology development to assess alternative designs and address technological deficiencies. The following activities would be required to support the Emergency Response mission:

- training, drills, experiments, and technology development activities for emergency response personnel
- constructing mock-ups of realistic weapons designs to test, develop, and validate detection equipment and methods to maintain emergency response capabilities
- using nuclear material to conduct criticality experiments to avoid technological surprises in response assets

Nonproliferation and Safeguards and Arms Control

The Office of Defense Nuclear Nonproliferation within the National Nuclear Security Administration has detailed its requirements for the capabilities at TA-18 in a briefing to the Secretary of Energy and in strategic planning documents. The principal concerns of the Office of Defense Nuclear Nonproliferation regarding the decision to relocate the Los Alamos TA-18 mission operations are the needs for continuity of nuclear measurement methods development and cooperation with treaty requirements without interruption to program missions. The program requires continuing access to SNM weapons components and nuclear explosive-like assemblies on an uninterrupted basis for nuclear radiation measurements. This access must be available both with and without the presence of foreign nationals.

These efforts support international treaties and agreements as well as counters to nuclear smuggling, domestic and international safeguards, and the intelligence community. Requirements of this program are such that a loss in the continuity of nuclear materials measurement capability would seriously damage all such efforts, including support for high-visibility treaties and agreements associated with: (1) the highly enriched uranium purchase agreement with Russia; (2) the trilateral agreement for verification and monitoring of material excessed from Russian and U.S. nuclear weapons programs; (3) the verifiability of weapons material storage at the Mayak Production Association in Ozersk, Russia; (4) the Strategic Arms Reduction Treaty (START) III; and (5) the training of inspectors and the development of safeguards technology for the International Atomic Energy Agency.

Operations at TA-18 have already played a pivotal role in the development of verification technology for the START I and Intermediate-Range Nuclear Forces Agreements. Additionally, TA-18 operational capabilities provide ongoing training of inspectors and development of safeguards technology for the International Atomic Energy Agency. The following activities would be performed to support nuclear nonproliferation and safeguards and arms control:

- supporting development and testing of technologies for conducting nuclear measurements for verification or transparency of declarations concerning nuclear weapons
- developing and evaluating new technologies for conducting nuclear measurements to determine the presence of nuclear materials
- conducting training of enforcement and emergency response personnel using nuclear materials in realistic settings
- providing independent assessment of other Federal agencies' technologies to assist in the selection of emergency response capabilities

Stewardship Science

Stockpile stewardship is a principal mission responsibility of the National Nuclear Security Administration, pursuant to national policy, presidential directives, and public law. A major element of this mission responsibility is the development and application of scientific and technical capabilities to assure the continued safety and reliability of U.S. nuclear weapons in the absence of underground nuclear testing. In addition to the other operational capabilities already described, TA-18 facilities may, in principle, provide data specifically for stockpile stewardship. However, this capability area is identified in this document as Stewardship Science to distinguish it from direct or indirect support to stewardship that accrues through efforts related to the Nuclear Materials Management and Criticality Safety mission. Although deliverable data or technologies for the Stewardship Science Program are not currently requirements of the TA-18 facilities, such program support is foreseeable in the future because of the availability of capabilities that are anticipated to be driven by other active, ongoing mission support activities.

3.1.2 Facilities, Personnel, and Materials Requirements

A diverse team sponsored by the DOE Office of Defense Programs was selected to review DOE's mission requirements presently supported at LANL's TA-18. This review encompassed all past, current, and any envisioned mission requirements, including all of the operational capabilities identified above. The team was tasked with recommending needed facilities, as well as requirements for special experimental equipment, personnel, and materials to support the operational capabilities and materials supported at TA-18.

Three subteams for the major mission requirements (Nuclear Materials Management and Criticality Safety, Emergency Response, and Nonproliferation and Safeguards and Arms Control) were established. The subteams were responsible for providing input for the review report that delineates the facility, equipment, personnel, and material requirements to support planned and projected mission requirement workloads. These program-area subteams were also required to work together to reach a consensus on the totality of requirements to support all of the necessary program activities. Important considerations in conducting the validation efforts included the following:

- The needs of all DOE programs with TA-18 ties were evaluated, including the need for uninterrupted support during transition to another location.

- The team considered all long-term mission requirements to ensure that associated facilities, equipment, and materials were identified.

- The team assumed that the plan was to relocate all security Category I/II programmatic work.

- Nuclear material requirements were reviewed from the perspective that some nuclear materials may be unique, costly, or may take a significant amount of time to reproduce. Therefore, when reviewing material requirements to support validated program needs, the team conservatively recommended which materials should be retained to support TA-18 operations at LANL or alternate sites and which other nuclear materials should be destined for storage or disposition.

The TA-18 mission requirements review team reached consensus on the required facilities, equipment, personnel, and materials necessary to support the operational capabilities deemed necessary. The requirements are detailed in the project's *Functional and Operational Requirements Document* (DOE 2000k) and are briefly discussed below.

Facilities and Equipment

The facilities needed to support current and future DOE mission requirements and TA-18 operational capabilities would consist of security Category I SNM experimental bays with control rooms for critical assembly machines, SNM storage vaults, storage areas, SNM shipping and receiving areas, a low-scatter facility, a radiography bay, office space, conference rooms, training facilities, access control areas, change-room facilities, a machine shop, an electronics fabrication shop, and other facilities necessary to meet the requirements for the safe handling of nuclear materials.

Four security Category I/II SNM critical assembly machines are required to support ongoing TA-18 operational capability requirements. These machines, discussed below, would be refurbished or replaced and relocated from TA-18 if a relocation alternative is selected.

- A general-purpose vertical-lift table machine for training and initial assembly of new experiments. Vertical-lift machines are ideal for this purpose because the stored energy for disassembly is provided by gravity. At the present time, the Planet machine provides this function.

- A fast-neutron-spectrum benchmarked assembly for validation of calculational methods, basic measurements of nuclear data of interest to defense and nuclear nonproliferation programs, and training. At the present time, the Flattop assembly serves this purpose.

- A pulse assembly to validate dynamic weapons models, verify the function of criticality alarm systems to a fast transient, calibrate detectors, and validate radiation dosimetry. The Godiva assembly provides this function at the present time.

- A large-capacity, general-purpose vertical table machine to accommodate benchmark experiments designed to explore unknowns. The Comet machine at TA-18 is currently used for this purpose. It is presently stacked with a massive assembly to evaluate intermediate neutron spectra for the first time.

The current operations at TA-18 are also supported by the Solution High-Energy Burst Assembly (SHEBA). SHEBA is a low-enriched uranium-solution critical assembly security Category IV SNM machine. It provides capabilities for free-field irradiation of criticality alarm systems and dosimetry validation. The SHEBA activities relocation under the various alternatives is discussed in detail in later sections of this *Final Environmental Impact Statement for the Proposed Relocation of Technical Area 18 Capabilities and*

Materials at the Los Alamos National Laboratory (TA-18 Relocation EIS); they would not be relocated from the Los Alamos National Laboratory (LANL), but could be relocated to a new technical area at LANL.

Table 3–1 lists the typical operational characteristics of each type of critical assembly machine. Appendix A provides a detailed description of the critical assembly machines currently operating at TA-18.

Table 3–1 Critical Assembly Machine Typical Operational Characteristics

	General-Purpose Critical Assembly Machine (Planet)	***Benchmark Critical Assembly Machine (Flattop)***	***Metal Fast-Pulse Critical Assembly Machine (Godiva)***	***Large-Capacity General-Purpose Critical Assembly Machine (Comet)***	***Low-Enriched Uranium-Solution Critical Assembly Machine (SHEBA)***
Space or Environmental Needs	Shielding adequate for low-power operations; heavy shielding required for uranium-233	Shielding adequate for free run	Shielding adequate for high-power burst operation; shielded area required for electronics	Shielding adequate for high-power operations; heavy shielding required for uranium-233	Shielding adequate for high-power operations; free-field irradiation capability for criticality alarm testing
Neutron Production	100 rad maximum at 1 meter; 1 rad typical	100 rad total from free run	10^{17} neutrons per burst; 50,000 rad contact; 1,000 rad at 1 meter	100 rad maximum; 0.1 rad at 1 meter	5×10^{17} fissions in burst mode; equals approximately 1,400 rad at 3 meters
Gamma Production	100 rad maximum at 1 meter; 1 rad typical	100 rad total from free run	100 rad at 1 meter	100 rad maximum; 0.1 rad typical at 1 meter	1,400 rad at 3 meters
Criticality Duration	Steady-state assembly	about 1 hour	25 to 150 microseconds	Steady-state assembly	2 hours for free runs or burst operations; 4 to 8 hours for steady-state operations
Frequency of Operation	150 days per year	50 days per year	200 days per year	100 days per year	100 days per year
Typical Radiation Levels	1 hour after shutdown: 0.01 rad per hour gamma; 0.01 rad per hour neutron	0.01 rad per hour at contact; maximum 0.03 rad per hour at contact	300 rad per hour at 1 foot after 1 hour; 30 rad per hour at 1 foot after 12 hours	0.01 rad per hour depending on power history	50 rad per hour at 6 feet, 30 minutes after a run; 0.2 rem per hour at 3 feet, 24 hours after a run; 0.1 rem per hour at 1 foot, 1 week after a run
Contamination	Negligible levels of contamination	Area contamination during operation	Area contamination during operation	Contamination during fuel handling	Potential for removable contamination from fuel spills

Rad = radiation absorbed dose (see Chapter 8 for the definition).
Source: DOE 2000k.

In addition, any facilities that would replace TA-18 would need to provide sufficient space and capabilities to accommodate future experimental machines, which are anticipated to use security Category I SNM. These include:

- A plutonium-solution machine designed to evaluate an anomalous positive temperature coefficient for dilute plutonium solution. This machine would require approximately 93 square meters (1,000 square feet) of floor space and an ability to store up to 200 liters (53 gallons) of plutonium solutions. Due to the significant infrastructure requirements to support plutonium solutions, LANL would be the only site considered for this future capability, irrespective of the alternative selected under this *TA-18 Relocation EIS*.

- A general-purpose horizontal split table designed for large experiments that cannot be accommodated on a vertical-lift split table. The Honeycomb and Big Ten machines provided this function until they were dismantled because the machines could no longer meet contemporary requirements for operational handling and safety. A new machine would require approximately 70 square meters (750 square feet) of floor space and weigh as much as 2.3 metric tons (2.5 tons).

- A low-temperature (cryogenic) critical assembly machine designed to evaluate potential space reactor applications. The machine would require approximately 70 square meters (750 square feet) of floor space, as well as access to cryogenic facilities (e.g., liquid nitrogen and liquid helium).

None of these future experimental machines are proposed actions in this environmental impact statement (EIS), and, thus, their operation is not analyzed in this EIS.

Personnel

Technical staff are needed (including physicists, engineers, and technicians) to perform existing TA-18 and new-facility mission support functions. These personnel require significant unique experience in nuclear criticality safety experiments and nuclear materials handling; neutron, gamma, and x-ray measurements; nuclear instrumentation design; and real-time radiography. Additionally, the personnel need significant experience in hazard Category 2, security Category I SNM nuclear facility operations, authorization-basis development and maintenance, and quality assurance. Also, a number of other support personnel, including safeguards-and-security-knowledgeable personnel, are needed to implement the security requirements for the protection of SNM.

Materials

The current inventory of nuclear material at TA-18 consists of approximately 2.8 metric tons (3.1 tons) of security Category I SNM and 18.5 metric tons (20 tons) of depleted and natural uranium and thorium. However, as a result of a concerted effort to reduce unnecessary site inventory, the forecasted mission support need would be to accommodate approximately 2.4 metric tons (2.6 tons) of security Category I SNM and 10 metric tons (11 tons) of depleted natural uranium and thorium (which do not require special security arrangements). The SNM inventory consists of uranium in all forms and enrichments and plutonium (mostly metals, double-encapsulated or clad), with a wide variety of contents including plutonium-240, uranium-233, neptunium-237, thorium, and other isotopic sources. The materials are in various forms that are useful for experiments to fulfill the TA-18 mission requirements.

Some of the nuclear material is considered “U.S. National Asset” nuclear material because of its uniqueness and usefulness for research to fulfill national mission requirements and because its replacement costs to taxpayers would be prohibitive in the current political, regulatory, and economic environment. If a relocation alternative is selected, this material would be transported from TA-18 to the new facilities.

3.2 DEVELOPMENT OF REASONABLE ALTERNATIVES FOR THE TA-18 MISSIONS

The *TA-18 Relocation EIS* evaluates the environmental impacts associated with the proposed action of relocating TA-18 capabilities and materials associated with security Category I/II activities to the following DOE sites: (1) a different location at LANL at Los Alamos, New Mexico; (2) the Sandia National Laboratories/New Mexico (SNL/NM) at Albuquerque, New Mexico; (3) the Nevada Test Site (NTS) near Las Vegas, Nevada; and (4) the Argonne National Laboratory-West (ANL-W) near Idaho Falls, Idaho. These site alternatives were developed by a DOE-wide Option Study Group chartered to develop reasonable alternatives for the relocation of TA-18 operations. Criteria were developed that screened for sites with existing security Category I infrastructure; nuclear environmental, safety, and health infrastructure; and compatibility between the site and TA-18 operational capabilities. The process is described in Section 3.2.2 below. In conjunction with the relocation of security Category I/II activities, the EIS also evaluates the environmental impacts associated with the relocation of TA-18 Category III/IV activities within LANL.

3.2.1 Planning Assumptions and Bases for Analysis

For the *TA-18 Relocation EIS* alternatives, the EIS evaluates relocating the operations associated with security Category I/II activities currently performed at LANL's TA-18 to one of four alternative locations. The EIS evaluates the direct, indirect, and cumulative impacts associated with (1) the relocation of criticality operational capabilities and support equipment to each of the four alternative locations; (2) the relocation of some of the inventory of nuclear materials currently stored at TA-18 to each of the four alternative locations; (3) the construction of new or the modification of existing facilities to accommodate the security Category I/II activities at each of the alternative locations; and (4) the operation of the new or existing facility(s) for a 25-year duration. The EIS also discusses in a generic and qualitative manner the eventual decontamination and decommissioning of any new facility proposed for construction and the disposition of TA-18 buildings, infrastructure, and surplus equipment after the proposed relocation. In addition, the EIS evaluates the environmental impacts associated with the continuation of the operations at TA-18 by upgrading the existing TA-18 facilities (TA-18 Upgrade Alternative) and the relocation of SHEBA and other security Category III/IV activities, currently performed at TA-18, to another location(s) within LANL. Some of the more specific assumptions and considerations that form the bases of the analyses and impact assessments that are the subject of this EIS are presented below.

- As required by the Council on Environmental Quality regulations, the *TA-18 Relocation EIS* evaluates a No Action Alternative for comparison purposes. The No Action Alternative, which currently supports mission requirements at TA-18, may limit DOE's ability to support future DOE mission requirements.

- TA-18 operations consist of security Category I/II activities, as well as security Category III/IV activities. Security concerns regarding the relocation of TA-18 mission operations primarily involve security Category I/II activities. Relocating the TA-18 security Category I/II activities to a new location within an existing security Category I/II area has the potential to reduce life-cycle costs and improve safeguards and security. While there are no similar security concerns involving security Category III/IV activities, existing infrastructure problems at TA-18 necessitate addressing the relocation of these activities in conjunction with the relocation of security Category I/II activities. The separate treatment of the relocation of TA-18 activities in terms of security categories is reflected in the presentation of the alternatives as discussed in Section 3.3.

- The projected start dates and estimated duration of modifications and construction for each alternative vary with each site; the schedule is discussed under each alternative in Section 3.3. The periods fall in the range of 2 to 3 years. For the purpose of the analysis, it was assumed that construction under any of the alternatives would start sometime in 2004 to 2005 and would be completed by sometime in 2007 to

2008, for a construction period of 3 years. Operations would start in 2008. In accordance with the *Functional and Operational Requirements Document* (DOE 2000k), the TA-18 replacement facility subsystems and components (including criticality experiments machines) would be designed for a service life of at least 25 years. Therefore, the EIS assesses the environmental impacts associated with the operation of the existing or new facilities for a period of 25 years, at which time the structures would undergo decontamination and decommissioning.

- The new buildings proposed for the relocation of the TA-18 capabilities and materials are in a preliminary design stage. Therefore, they are not described in detail in this EIS. However, for the purpose of the environmental impact analysis, conservative assumptions have been used such that construction requirements and operational characteristics of these buildings would maximize the environmental impacts. Thus, the potential impacts from the implementation of the finalized-design alternatives would be less severe than those analyzed in this EIS.

- Of the critical assembly machines proposed for relocation, Comet, Planet, and Flattop are over 40 years old and extensive refurbishment or replacement of these machines would be required before continuing their missions. Godiva is slightly more modern and many of its subsystems have been recently upgraded.

  Flattop would be rebuilt using the original uranium parts; all other parts would be new. A new smaller table would be built with separated hydraulics and electrical components, simplified and more accessible control rod drives, and a modern control system. The refurbishment is expected to have minimal environmental impacts, and its operational characteristics would remain the same. The old table, electrical racks, and hydraulic systems would be disposed of as low-level radioactive waste. The waste stream would be less than 4.6 metric tons (5 tons) of low-level radioactive waste. There is a potential that lead-based paint may have been used on the table, which would result in part of the waste stream being characterized as mixed radioactive waste.

  The two general assembly machines (Comet and Planet) would be moved, one at a time, to the new facility in a staged transition. This would require building a new machine stand and control assembly. A second control cartridge and stand would be manufactured, and the second machine would then be moved and brought into service. The waste stream would include two control cartridges and two machine stands and would be less than 0.9 metric tons (1 ton) of low-level radioactive waste each. The machine stands may potentially have lead-based paint on them due to the formulation of most paints at the time the stands were painted.

  The Godiva stand would be used as is. It would be defueled before shipment and reassembled at the final destination. Most of the hydraulic and air systems have been refurbished recently. The 110-volt alternating-current control system would be replaced by a 24-volt direct-current control system. Some of the limit switches and wiring would be refurbished. The waste stream would be minimal and would be mostly low-level radioactive waste.

- Unique technical knowledge and experience in nuclear criticality is necessary to maintain TA-18 operational capabilities and to fulfill programmatic requirements. The expertise required to perform each mission set overlaps certain key skills such that many of the technical experts work in two or more major programmatic areas and, therefore, cannot easily be separated. Additionally, TA-18 technical personnel interact routinely with multiple organizations in LANL to collaborate on research and development issues involving weapon design and detector technology.

  To capitalize on this synergy, DOE has determined that LANL will retain responsibility for the TA-18 missions, regardless of the final location for security Category I/II operations. If a location other than LANL were selected for security Category I/II operations, LANL personnel will continue to maintain responsibility for those missions. Under this scenario, it is likely that security Category I/II operations would be conducted in a campaign mode with LANL personnel traveling to the new location on a temporary basis to conduct experiments. In addition, up to 20 support and operations personnel may be permanently relocated. To minimize programmatic impacts to TA-18 missions, DOE proposes that security Category III/IV operations remain at LANL so that TA-18 personnel can continue to routinely collaborate with other experts in a research and development environment.

- Proven technology is used as a baseline. No credit is taken for emerging technology improvements.

- The core set of accident scenarios selected from the *Basis for Interim Operations for the Los Alamos Critical Experiments Facility (LACEF) and Hillside Vault (PL-26)* at Los Alamos (DOE 2001a) are applicable to each relocation alternative with adjustments to certain parameter values (e.g., leak path factors and materials at risk) to reflect site-specific features. Added to the core set of accidents are other site-specific accidents, if any, caused by natural phenomena or accidents at collocated facilities, that have the potential for initiating accidents at the relocated TA-18. The impacts of accidents analyzed for each alternative reflect and bound the impacts of all reasonably foreseeable accidents that could occur if the alternative were implemented.

- Decontamination and decommissioning of facilities as a result of the proposed action pertains to two distinct areas: (1) decontamination and decommissioning of the existing TA-18 facilities if all current operations and materials are relocated and no other program support personnel use the vacated facilities, and (2) decontamination and decommissioning of existing or new relocation facilities at the end of the proposed operation period. At the present time, the ultimate disposition of either the existing TA-18 structures or the proposed equipment for relocation and its associated new structures is not known. However, the current condition and contamination history of the TA-18 facilities and the projected use of the alternative facilities allows a qualitative assessment of the nature and extent of decontamination that would be required to allow the facilities to be released for unrestricted use. Discussion is provided in Section 5.7.

- The relocation of the operational capabilities associated with security Category I/II activities from TA-18 would require transportation of the critical assembly machines as well as the security Category I SNM currently stored at TA-18 to the relocation site. The assumptions for the quantities and types of SNM or other materials that would be transported to the relocation site are provided in Appendix D. Any nuclear material currently at TA-18 not deemed needed for future missions would be dispositioned through normal channels by DOE and LANL in accordance with previously prepared or future National Environmental Policy Act documents.

- The operational characteristics of the critical assembly machines form the basis for the impact analysis at all other locations. These characteristics, based on the operation of TA-18 facilities as described in the *Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory (LANL SWEIS)* (DOE 1999b) for the projected Expanded Operations Alternative, are presented in **Table 3–2** and discussed briefly below.

Table 3–2 Operational Characteristics at TA-18

Electricity usage	2,836 megawatt-hours per year
Water usage	14.6 million liters per year
Nonradiological gaseous effluent	None
Radiological gaseous effluent	10 curies per year, argon-41 (Godiva); 100 curies per year, argon-41 (SHEBA)
Nonradiological liquid effluent	None
Radiological liquid effluent	None
Chemical effluent	None
Workforce	212 workers
Worker dose	21 person-rem per year, based on 212 workers
Waste generation	
- High-level radioactive waste	None
- Transuranic waste	None
- Low-level radioactive waste	145 cubic meters per year
- Mixed low-level radioactive waste	Less than 2 cubic meters per year
- Chemical waste (RCRA/TSCA waste)	4,000 kilograms per year
- Sanitary waste	14.6 million liters per year

RCRA = Resource Conservation and Recovery Act; TSCA = Toxic Substances Control Act.
Source: LANL 2001a.

Infrastructure Parameters—Activities associated with the operations at TA-18 are not energy- or water-use intensive. Electricity and water use at TA-18 are a small fraction of the sitewide use and would continue to be small fractions in all proposed relocation sites. There is limited use of natural gas and propane at TA-18.

Nonradiological Effluent—Criticality experiments and supporting activities do not involve nonradiological effluent in either gaseous or liquid form. However, diesel generators may be used as a source of emergency power at new locations. Emissions from diesel generator operation are included in the environmental analysis.

Radiological Effluent—The critical assemblies are designed to operate at low power and at temperatures well below phase-change transition temperatures. They do not generate significant radiological inventory of long-lived fission products and do not require forced convection cooling. Therefore, air-activation products, produced by interactions with the air outside of critical assemblies, are the primary source of air emissions.

Among the critical assemblies in TA-18, those intended for prompt critical operation, namely the Godiva assembly and SHEBA, are the major source of air-activation products. The Godiva assembly, in the past, was frequently operated outside of the remote-controlled Critical Assembly Storage Area (CASA) that houses it. This practice would not be continued if the activities are relocated. SHEBA, which is housed in a small weather-proof building that provides no shielding, is the major contributor to the air-activation products. The Planet, Comet, and Flattop assemblies run at lower-power levels (low fission rates) and operate inside the building, which reduces the air-activation products.

The air-activation products are generated from neutron interaction with air molecules containing argon, nitrogen, and oxygen. The radionuclide of greatest concern is argon-41, due to its 1.82-hour half-life and relatively large neutron-absorption cross section.

Air-activation products from neutron interaction generated during the operation of SHEBA and Godiva (assumed to be operating outside of CASA 3) were estimated assuming a 120-meter (394-foot) hemisphere of air surrounding each critical assembly (DOE 1999b). Although future operations of Godiva would not take place outside, for the relocation alternatives, argon-41 generation from Godiva operations is conservatively assumed to be 10 curies per year, based on TA-18 practices. Argon-41 generation from SHEBA operations is assumed to be 100 curies per year. There is negligible argon-41 generation from the operation of the other critical assemblies.

Chemical Effluent—Criticality experiments and supporting activities do not involve the normal release of any chemicals in a gaseous or liquid form.

Worker Dose—The total annual dose to workers at TA-18 was estimated to be 21 person-rem for 212 workers. This corresponds to an average of 0.1 rem per worker per year, which was assumed to be the single worker annual dose from routine operations.

Workforce—The workforce at TA-18 is approximately 200. For the purpose of estimating total worker dose, the workforce at sites other than TA-18 was assumed to be 100 (excludes personnel for security Category III/IV activities). For the purpose of assessing socioeconomic effects, it was assumed that up to 20 persons would relocate permanently away from LANL, should a site other than LANL be selected.

Waste Generation—Criticality experiments and supporting activities involve some generation of low-level radioactive waste, primarily consisting of personnel protective equipment, wipes and rags. They also involve the generation of small quantities of mixed low-level radioactive waste consisting of machine shop scraps, solvents, and wipes. No high-level radioactive or transuranic waste is generated. The operations involve the generation of about 4,000 kilograms (8,800 pounds) of hazardous chemical solids annually from chemicals and solvents used during support activities.

3.2.2 Site Alternatives

In the fall of 1999, DOE formed an Options Study Group (Group) to consider the needs associated with the relocation of TA-18 operational capabilities and materials. On November 3, 1999, the Deputy Secretary of Defense Programs tasked the Group to identify alternate siting options for TA-18 operations. The Group was to consider costs, budgets, and schedules for design, modification/construction, and operation of existing, replacement, or new structures, including security and general environmental, safety infrastructure, and health requirements. The Group was further tasked to report back to the Energy Secretary with a recommendation supported by a proposed transition plan that would ensure continuity of criticality training and retention of critical staff to manage and operate these criticality-associated facilities.

To meet the Secretary's goals, the Group developed siting criteria that were ultimately used to determine the reasonableness of a site for the security Category I/II TA-18 operations. Three Go/No-Go criteria and three desired criteria were developed, as shown in **Table 3–3** (DOE 2001b).

Table 3–3 Site Selection Criteria

Criterion	*Type of Criterion*
Existing infrastructure to support security Category I/II requirements	Go/No-Go
Existing nuclear facility environmental, safety, and health infrastructure	Go/No-Go
Existing long-term mission support compatibility with TA-18 operations	Go/No-Go
Low cost of upgrades for safety and security readiness	Desired
Low cost of maintenance and operations	Desired
Maintenance of long-term competencies	Desired

During the initial screening process, all DOE sites were considered. The DOE sites that did not pass the screening criteria were Rocky Flats, Hanford, the Idaho National Engineering and Environmental Laboratory, and Brookhaven National Laboratory. In addition to the DOE sites, the Group also considered possible relocation to U.S. Department of Defense installations. However, serious concerns were raised by the Group regarding long-term mission compatibility and security Category I requirements; therefore, the Department of Defense sites were removed from further consideration.

All DOE sites that passed the initial screening criteria were asked to submit additional site information. Five sites—Pantex (Amarillo, Texas), the Y-12 Plant (Oak Ridge, Tennessee), Oak Ridge National Laboratory (Oak Ridge, Tennessee), the Savannah River Site (Aiken, South Carolina), and Lawrence Livermore National Laboratory (Livermore, California)—were eliminated from further consideration, as they did not meet the site detailed selection criteria.

Five responses were submitted from four DOE sites: TA-18 and TA-55 at LANL, TA-V at SNL/NM, the Device Assembly Facility (DAF) at NTS, and the Fuel Manufacturing Facility (FMF) at ANL-W. In the process of determining suitable locations for TA-18 operations, DOE considered other siting options and facility configurations at these four sites. However, only these five responses met the site selection criteria. Based on this information, as well as information obtained during site visits, these five locations were scored against the three desired criteria. Based on these results and other information, the Secretary of Energy announced that DOE is proceeding with this EIS.

3.2.3 Technology Alternatives

Section 3.1.2 describes the process used to determine technology requirements for current and future TA-18 missions. No future technologies were developed or conceptualized beyond the current concepts on which the operations of the critical assembly machines are based. Although potential enhancements in the handling and operation of these machines are possible through refurbishments and upgrading, no credit for such enhancements is taken in this EIS.

3.3 ALTERNATIVES EVALUATED

The sections below provide a description of the alternatives evaluated in the *TA-18 Relocation EIS*, along with descriptions of the facilities, existing or proposed, building modifications, and construction and operations requirements associated with each alternative. **Table 3–4** illustrates the proposed relocation sites for the TA-18 capabilities and materials.

Table 3–4 Proposed Relocation Sites for TA-18 Capabilities and Materials

Activities	*No Action Alternative*	*TA-18 Upgrade Alternative*	*LANL New Facility Alternative*	*SNL/NM Alternative*	*NTS Alternative*	*ANL-W Alternative*
Security Category I/II	TA-18	TA-18	TA-55	TA-V	DAF	FMF/ZPPR
SHEBA (Security Category IV)	TA-18	TA-18	TA-39 or TA-18	TA-39 or TA-18	TA-39 or TA-18	TA-39 or TA-18
Other (Security Category III/IV)	TA-18	TA-18	TA-55 or TA-18	TA-18	TA-18	TA-18

DAF = Device Assembly Facility; FMF = Fuel Manufacturing Facility; ZPPR = Zero Power Physics Reactor.

3.3.1 No Action Alternative

As required by the Council on Environmental Quality regulations, the *TA-18 Relocation EIS* includes the No Action Alternative of maintaining the operations and materials at the current TA-18 location. Under the No Action Alternative, current operational capabilities and materials at TA-18 would be maintained as described in the Expanded Operations Alternative of the *LANL SWEIS* and associated Record of Decision (64 FR 50797, September 20, 1999). The No Action Alternative may limit DOE's ability to support future DOE mission support requirements unless significant upgrades to the TA-18 infrastructure are accomplished.

3.3.1.1 Facilities

Under the No Action Alternative, the operations conducted at TA-18 would continue at the level described in the *LANL SWEIS* (DOE 1999b) with no major buildings, facility modifications, or changes to the infrastructure associated with buildings or safeguards and security. Current SNM inventories (all security categories), as well as the criticality experiments machines, would remain in place. Descriptions of the TA-18 buildings, structures, and equipment are provided below.

The TA-18 buildings and structures are located at the Pajarito site, about 5 kilometers (3.1 miles) from the nearest residential area (the White Rock community) and about 400 meters (0.25 miles) from the closest technical area (TA-54) (see **Figure 3–1**). The Pajarito site is in an arid canyon and the surrounding canyon walls provide some natural shielding for the TA-18 facilities.

The facilities consist of three remote-controlled laboratories (Buildings 23, 32, and 116), or CASAs, and a separate weatherproof shelter near Building 23 that houses the SHEBA machine (Building 168). These facilities are located some distance from the main laboratory (Building 30) that houses individual control rooms for these remote-controlled laboratories. A PIDAS surrounds each CASA. The SHEBA building is within the PIDAS of CASA 1.

Each CASA is surrounded by a physical security boundary that is evacuated before remote operation, and automatic signals forewarn anyone who might be overlooked during building evacuation prior to the initiation of experimental operations. When the gate to this area is open, operation is prevented by interlocks and by key-actuated switches that require the same (captive) key for applying power to assemblies and for opening the site.

Building 23 (CASA 1)

CASA 1 was designed in 1946 and built in 1947. It is located near the confluence of Pajarito Canyon and Three Mile Canyon at an elevation of approximately 2073 meters (6800 feet). The canyon walls, rising approximately 61 meters (200 feet) above the canyon floor, are 46 meters (150 feet) from the south wall and 15 meters (50 feet) from the north wall of CASA 1.

CASA 1 houses three general-purpose criticality experiments remote assembly machines: Mars, Venus, and Planet. Of these, only the Planet assembly is currently supporting operations at TA-18. These machines contain no permanently mounted nuclear fuel, but are designed to assemble critical masses in various configurations with provisions contained for mounting safety and control element drives. The Planet assembly is approximately 1.2 × 1.2 × 3 meters (4 × 4 × 10 feet) in size.

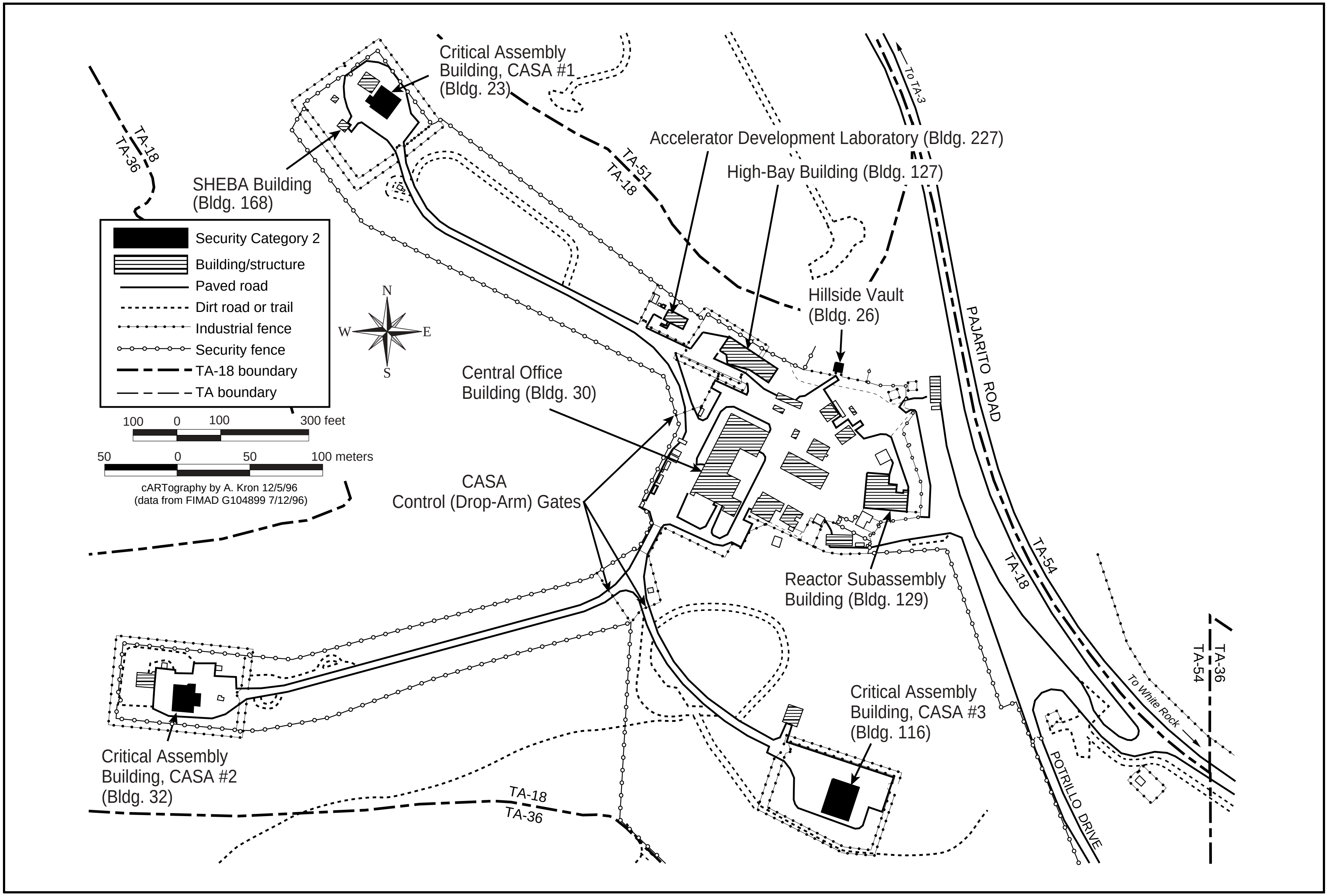

Figure 3–1 TA-18 Pajarito Site

Building 32 (CASA 2)

CASA 2 was designed in 1950 and built in 1952. It is a single-bay laboratory constructed of reinforced concrete walls and reinforced concrete slab and beam construction at the roof.

The critical assemblies in CASA 2 are Flattop and Comet. The Flattop assembly is a critical assembly designed to provide benchmark neutronic measurements in a spherical geometry with a number of different fissile driver materials. The Flattop assembly consists of a core of fissionable material at the center of a sphere of natural uranium. Each core is supported by its own natural uranium pedestal, which is mounted on a keyed track and may be moved in or out by a hand crank. This arrangement allows assembly of the core parts away from the reflector. The Flattop assembly is approximately 2.4 × 1.8 × 1.5 meters (8 × 6 × 5 feet) in size.

The Comet assembly is a general-purpose assembly machine designed to accommodate a wide variety of experiments in which neutron multiplication would be measured as a function of distance between components. In general, the configuration under study is split into two parts, one of which is mounted in a stationary position above and the other on a movable platen below. The entire Comet assembly is approximately 1.2 × 1.2 × 3.6 meters (4 × 4 × 12 feet) in size.

Building 116 (CASA 3)

CASA 3 was built in 1962. It is a single-story structure with a high-bay laboratory. It has no windows, nor does it use any glass blocks in its construction.

CASA 3 construction provides reasonable confinement in case of a relatively severe criticality accident. The one entrance to the main room is designed like a tunnel to minimize radiation scattering outside of the building, and it is oriented so that the entrance does not open toward the areas most frequently occupied by personnel or members of the public.

CASA 3 houses the critical assembly Godiva. The Godiva assembly is a fast-burst critical assembly machine with a bare enriched-uranium alloy metal core with no external reflector. The entire Godiva assembly is approximately 0.9 × 1.2 × 3 meters (3 × 4 × 10 feet) in size and, because of the duration of the pulse, needs no external cooling.

Building 168 (SHEBA Building)

Located approximately 18.3 meters (60 feet) southwest of CASA 1 is the SHEBA experiments Building 168.

The building is all metal, double-wall construction with rigid frames anchored to a concrete pad. All walls and the ceiling are fiberglass insulated. SHEBA is lowered into a pit in the floor of the building for high-radiation experiments, which provides shielding during the experiments and provides containment of any liquid release from SHEBA.

The SHEBA building provides only a weatherproof shelter for critical assemblies. No radiation shielding is provided by the structure. This is intentional, as radiation dose measurements and radiation instrumentation can be fielded around critical assemblies in the SHEBA building without the presence of shielding or building scatter.

Building 30 (Central Office Building)

The main offices of the operating group are located in Building 30. These include the offices of the group management, staff, and several counting laboratories and electronic assembly areas. In addition, Building 30 houses the main TA-18 machine shop. The CASA 1, 2, and 3 control rooms are located on the south side of the building. Building 30 is a single-story building constructed of reinforced concrete with a basement.

Building 26 (Hillside Vault)

The Hillside vault is located in the canyon wall at the northeast side of the TA-18 site. Materials and components are stored in sealed storage containers at designated storage locations. Containers are transported to other locations at TA-18 for use in experiments or radiation measurements. The vault is normally maintained to be free of detectable contamination and is subject to a very low occupancy factor.

Building 127 (High Bay)

Building 127, also known as the High Bay, is located next to the canyon wall at the north side of the site. It consists of a large room and a basement with an office complex. The experimental bay features a false floor and light walls to provide low scatter. This feature has led to the use of the facility for measurements that require a "clean" radiation environment. A two-story-high shield wall separates the experimental bay from the rest of the site.

Activities on the main floor include portable radiography and detector development for passive and active surveillance of fissile material. In the basement, there is currently a linear accelerator as well as a Kaman neutron generator. Both the linear accelerator and the neutron generator are connected to a scram system and a series of interlocks that allow their operation from the main-floor control room.

Building 127 can be used as a Material Access Area so that up to security Category I quantities of SNM can be temporarily brought into the building for experiments.

Building 129

Building 129 is located at the northeast end of the site. It is a concrete structure in which portal monitors and detection systems are developed and tested. It consists of one large room and several compartmentalized office and laboratory spaces. Both neutron and gamma-ray sources are used for detector development and calibration procedures. Fissionable material in Building 129 is limited to security Category III SNM.

Building 227

Radiography operations are conducted in Building 227. Building 227, the Accelerator Development Laboratory, is a concrete structure housing a radiofrequency quadruple accelerator in the main level and a tomographic gamma scanner and a radioactive waste drum counter in the basement. Both these devices use small sources (the tomographic gamma scanner uses cesium and barium sources and the drum counter uses a shielded pulsed neutron generator) or up to security Category III SNM inserted in matrices inside the drums to be used. A shielded control room is situated in the basement adjoining the laboratory space. The shielding is provided by a combination of both concrete and earth.

3.3.1.2 Annual Operations

The operational characteristics of the facilities under the No Action Alternative, common to all alternatives, are provided in Section 3.2.

3.3.1.3 Construction Requirements

The No Action Alternative does not involve new construction or upgrades to the existing structures or buildings.

3.3.2 TA-18 Upgrade Alternative

Under this alternative, the building infrastructure and security infrastructure at TA-18 would be upgraded to maintain the operations and SNM activities (all security categories) at the existing TA-18 facilities (LANL 2001a).

3.3.2.1 Facilities

For the TA-18 facilities to meet expected operational requirements and security needs, significant upgrades at TA-18 would be required. New construction and modifications proposed for continuing operations at TA-18 are described briefly below.

New construction would consist of: (1) a new one-story office and laboratory building, (2) a new one-story control room, (3) a new one-story pre-engineered metal storage building (dome warehouse), and (4) a storage vault added to Building 26 (Hillside vault). **Figure 3–2** provides a plan view of proposed modifications to existing structures and the addition of new structures. The figure provides three options for the location of the new office and laboratory space, shows the location of the new vault, provides two options for the location of the dome warehouse, and provides two options for the location of the control-room addition. The EIS evaluates Option 3 for the laboratory and office addition, Option 2 for the dome warehouse, and Option 2 for the control-room addition. These options were selected to maximize the impacts from a land-use point of view. In addition to new construction, various modifications to existing facilities would be needed, such as reroofing, reinforcing walls, painting, sealing cracks, and replacing glass blocks. **Figure 3–3** provides details of the proposed new construction.

In addition to new construction, the following would be needed:

- Installation of high-efficiency particulate air filters in conjunction with negative pressurization of the CASAs
- Extensive paving and surfacing improvements
- Replacement of potable and fire-protection water systems
- Replacement of the sanitary sewage system
- Storm-water management improvements
- Site grading
- Additions or replacements of heating, ventilating, and air conditioning; power distribution and monitoring; lightning protection; grounding; and surge suppression
- PIDAS upgrades
- Physical security enhancements

3.3.2.2 Annual Operations

The operational characteristics of the facilities under the TA-18 Upgrade Alternative, common to all alternatives, are provided in Section 3.2.

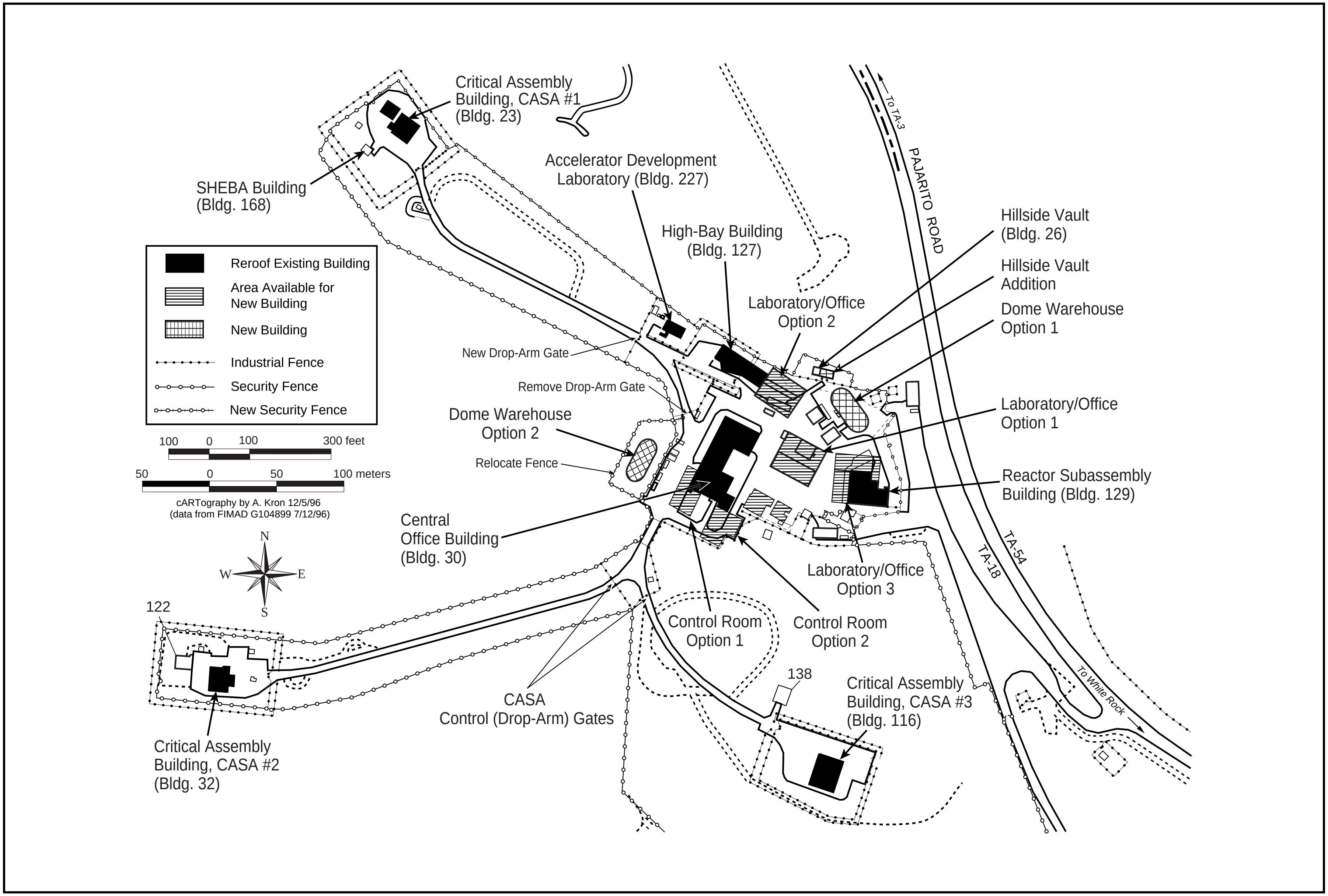

Figure 3–2 TA-18 Proposed Modifications Plan (TA-18 Upgrade Alternative)

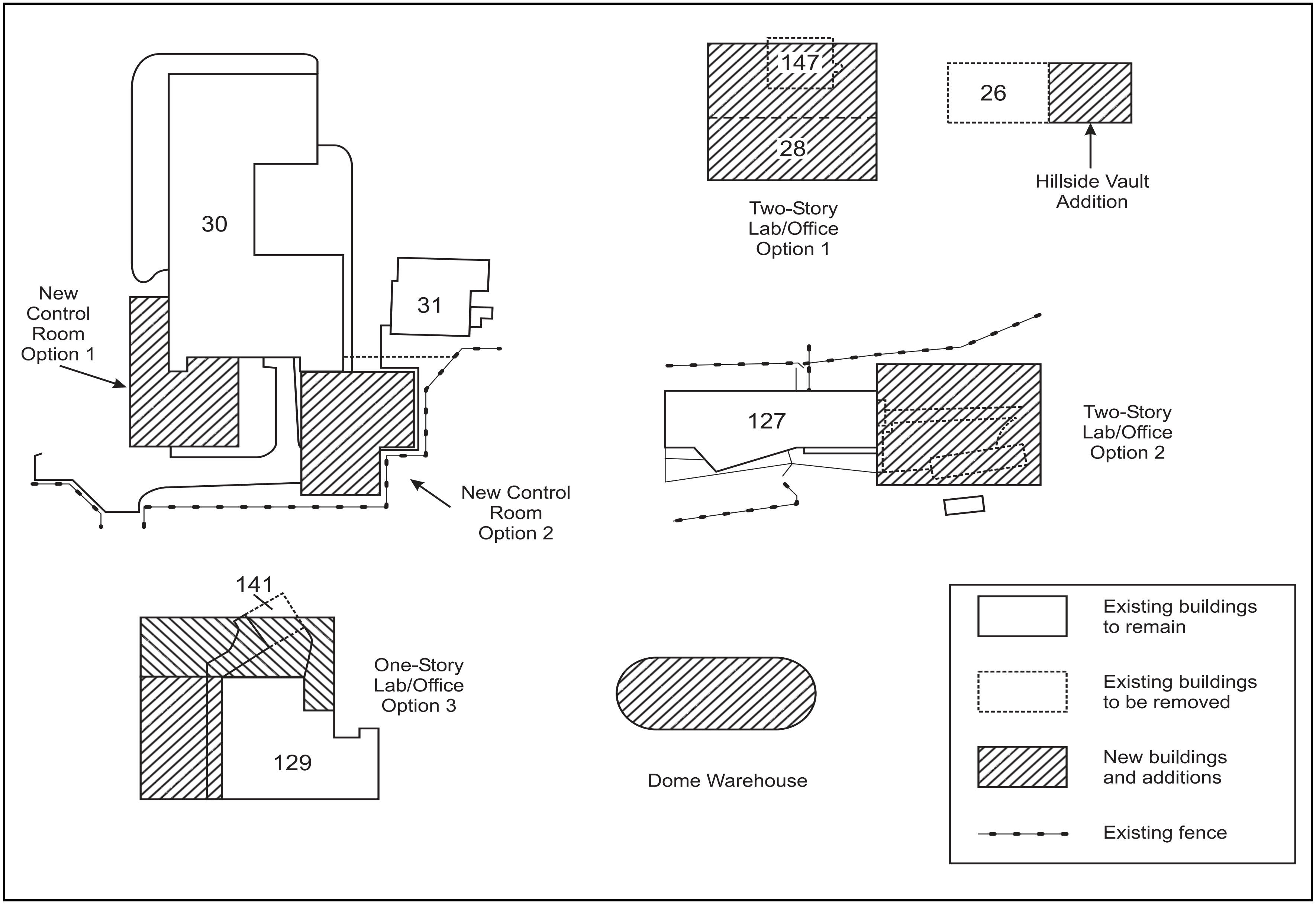

Figure 3–3 TA-18 Proposed New Construction (TA-18 Upgrade Alternative)

3.3.2.3 Construction Requirements

Table 3–5 shows the construction requirement parameters used for the environmental impact analysis.

Table 3–5 Construction Requirements under the TA-18 Upgrade Alternative

Requirement	*Quantity*
Electrical energy (megawatt hours)	378
Peak electrical demand (megawatts)	0.2
Concrete (cubic meters)	688
Steel (metric tons)	49
Fuel/gasoline (liters)	(a)
Water (liters)	5,800,000
Land (hectares)	0.2
Construction workers	
Total (during construction)	220
Peak	110
Construction time (months)	24

[a] Not provided. Considered to be part of construction costs; contractors to provide fuel/gasoline needed for their machinery.
Source: LANL 2001a.

3.3.3 LANL New Facility Alternative

This alternative would involve the relocation of TA-18 operational capabilities and materials associated with security Category I/II activities to new buildings northwest of the existing Plutonium Facility 4 in LANL's TA-55 and extension of the existing TA-55 PIDAS (LANL 2001a). The location of TA-55 within LANL is shown in Figure 4–1. The location of the proposed new buildings is shown in **Figure 3–4**. The site plan for the proposed buildings is shown in **Figure 3–5**. Under this alternative, a portion of the security Category III/IV activities (the SHEBA activities) would either be relocated to a new structure at TA-39 or remain at TA-18. The rest of the security Category III/IV activities would be relocated to a new structure at TA-55 or would remain at TA-18. The relocation of SHEBA and other security Category III/IV activities to new structures is discussed in Section 5.6.

3.3.3.1 Facilities

The new security Category I/II operations buildings would consist of above-grade structures that would house support operations and below-grade structures that would house criticality assembly areas and SNM vaults. The criticality assembly level would consist of criticality bays and SNM vaults that would be below-grade, with a minimum of 6 meters (20 feet) of cover consisting of rubble and earth. This level would consist of approximately 3,252 square meters (35,000 square feet) of floor space. Construction of the below-grade portions of the facility would consist of reinforced concrete. **Figure 3–6** shows the location of the critical assembly machines and SNM vaults at the critical assembly level. The control-room level would consist of the control rooms for the criticality bays and other support areas. The control-room level would be at grade and constructed of reinforced concrete. This level would consist of approximately 1,161 square meters (12,500 square feet) of floor space.

The new low-scatter bay would be a pre-engineered-type building with a 5-meter-deep (15-foot-deep) basement. The building would consist of approximately 604 square meters (6,500 square feet) of floor space. A PIDAS security fence would be constructed to surround the facility. Access to the facility would be through a Protected Area Access Control Building.

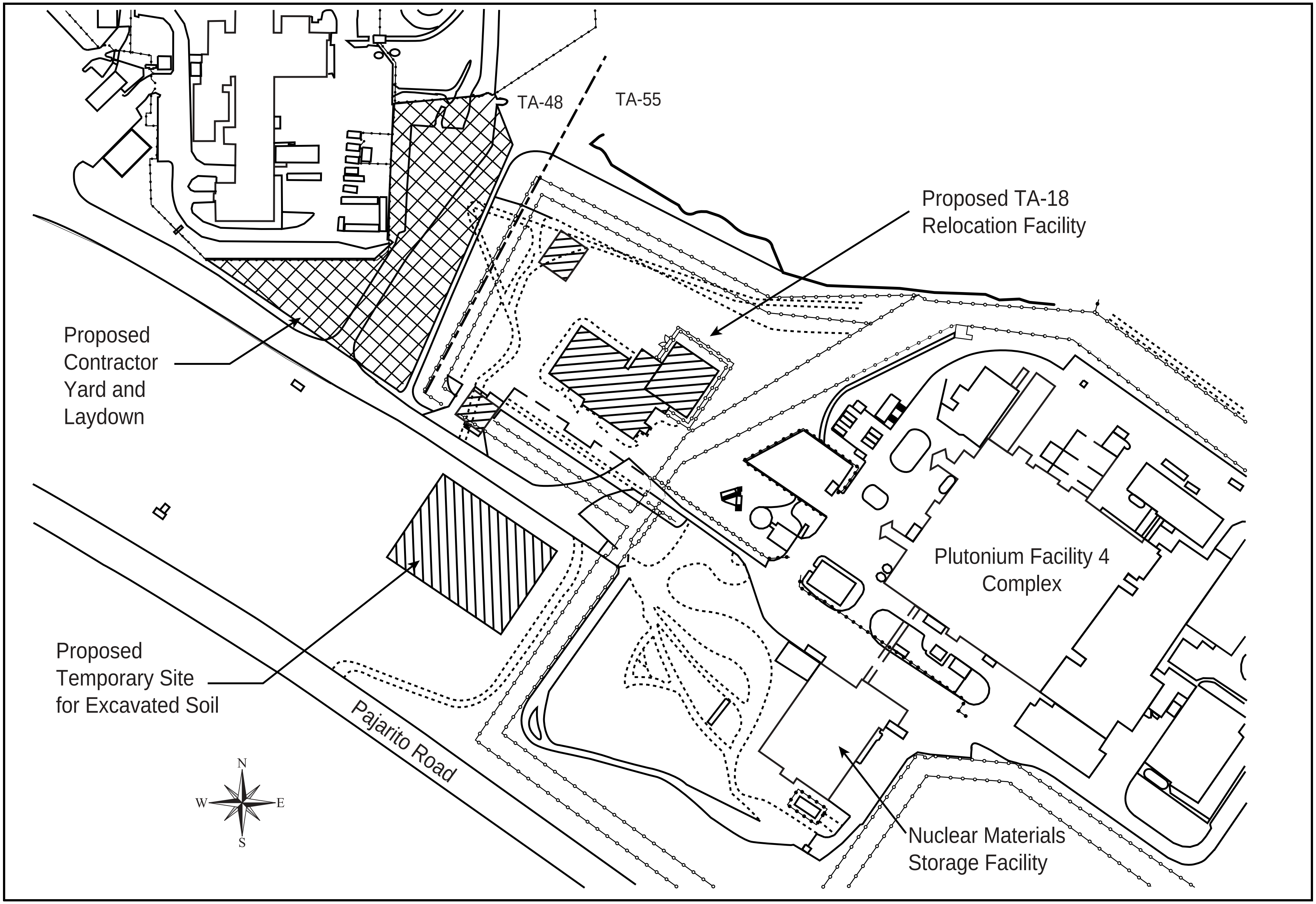

Figure 3–4 Location of the Proposed New Facility (LANL New Facility Alternative)

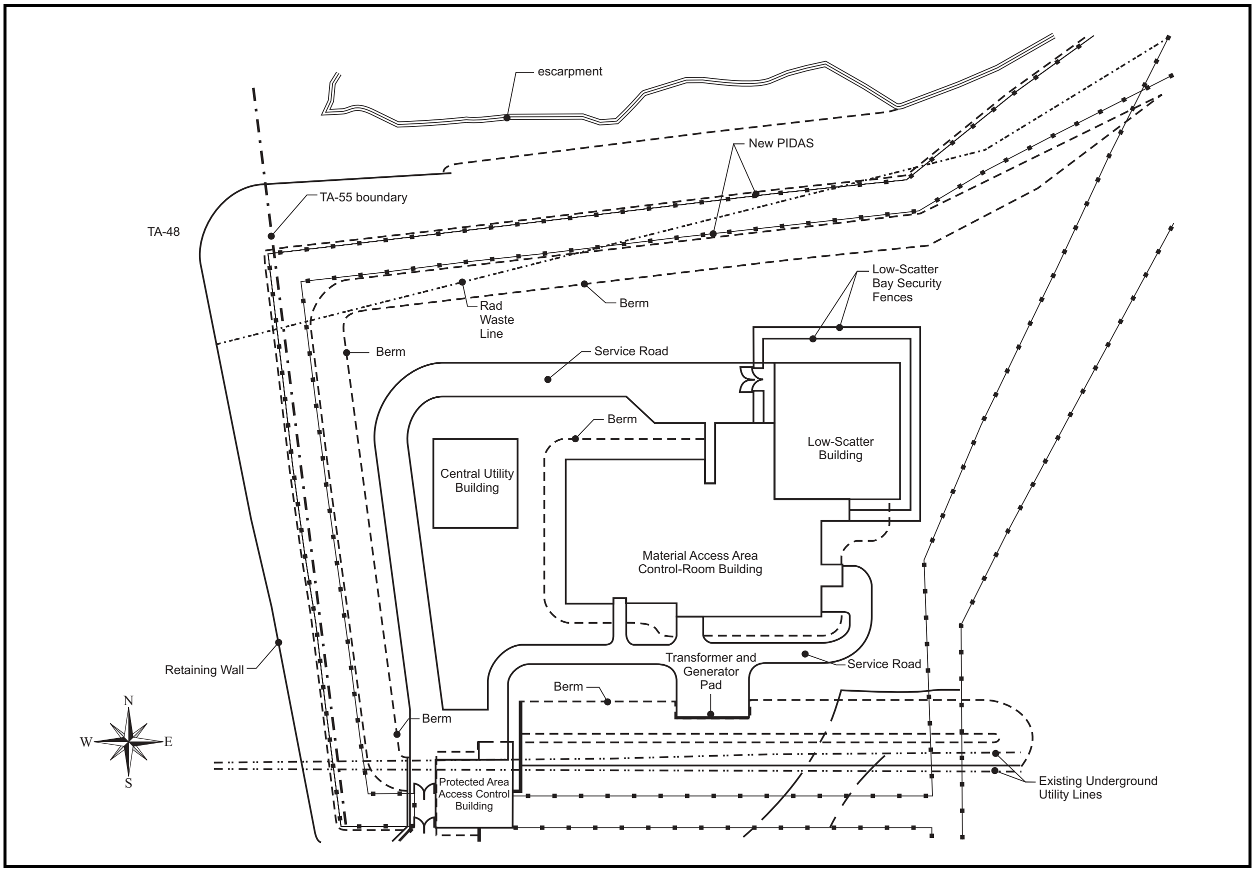

Figure 3–5 Site Plan for Proposed LANL Facility (LANL New Facility Alternative)

3.3.3.2 Annual Operations

The operational characteristics of the facilities under the LANL New Facility Alternative, common to all alternatives, are provided in Section 3.2.

3.3.3.3 Construction Requirements

Table 3–6 shows the construction requirement parameters used in the environmental impact analysis.

Table 3–6 Construction Requirements under the LANL New Facility Alternative

Requirement	*Quantity*
Electrical energy (megawatt hours)	170
Peak electrical demand (megawatts)	0.13
Concrete (cubic meters)	15,324
Steel (metric tons)	842
Fuel/gasoline (liters)	(a)
Water (liters)	22,700,000
Land (hectares)	1.82
Construction workers	
Total (during construction)	400
Peak	300
Construction time (months)	16

[a] Not provided. Considered to be part of construction costs; contractors to provide fuel/gasoline needed for their machinery.
Source: LANL 2001a.

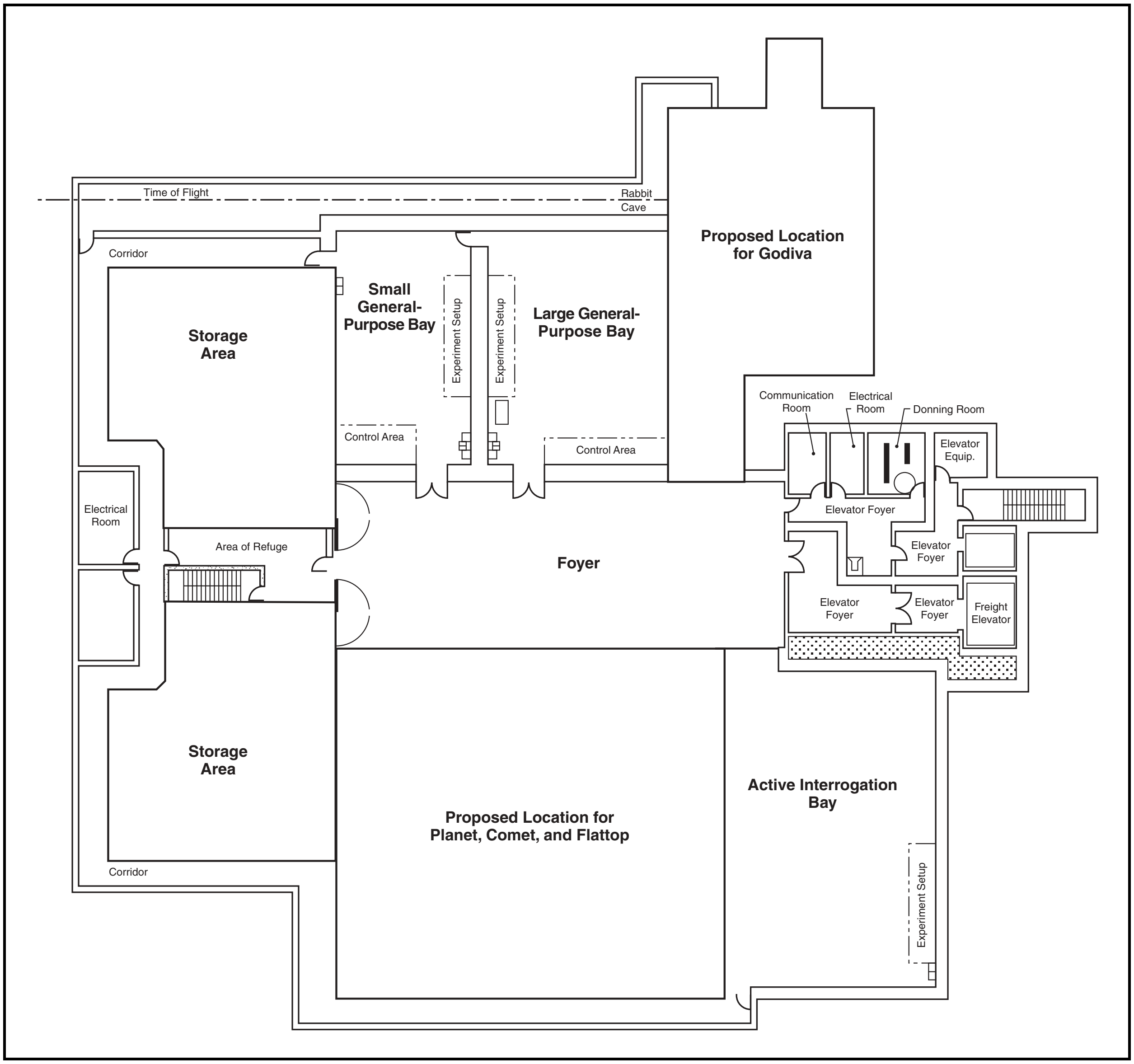

Figure 3–6 Location of Critical Assembly Machines and SNM Vaults (LANL New Facility Alternative)

3.3.4 SNL/NM Alternative

This alternative would involve the housing of the TA-18 operational capabilities and materials associated with security Category I/II activities within TA-V[1] at SNL/NM. Under this alternative, a portion of the security Category III/IV activities (the SHEBA activities) would either be relocated to a new structure at LANL's TA-39 or remain at TA-18. The rest of the security Category III/IV activities would remain at TA-18. The relocation of SHEBA and other security Category III/IV activities to new structures at LANL is discussed in Section 5.6.

[1] *Technical areas at SNL/NM are designated using roman numerals rather than the arabic numerals used at LANL.*

3.3.4.1 Facilities

To support the relocation of TA-18 operational capabilities and materials associated with security Category I/II activities, it is proposed to construct a new underground building and modify or renovate 10 existing aboveground buildings. All construction and renovation activities would be within SNL/NM's TA-V area (SNL/NM 2001b). The locations of the proposed new facility and existing facilities are shown in **Figure 3–7**.

The overall size of the new underground facility would be approximately 3,286 square meters (35,370 square feet); the areas proposed to be renovated in all 10 existing buildings would total approximately 5,007 square meters (53,895 square feet). Proposed new underground construction would include nuclear material storage vaults, the larger portion of the critical assembly facility, the active interrogation facility, and a general-purpose nuclear material work bay. **Figure 3–8** shows a schematic of the underground facility. Structures that would be located in the aboveground renovations would include emergency response staging and maintenance, electronics, and a machine shop and instrumentation laboratory in the Hot Cell Facility (Building 6580); the critical assembly control rooms and warehouse in the Auxiliary Hot Cell (Building 6597); a low-scatter facility in the chapel (Building 6596); waste management storage areas in the warehouse (Building 6595); and explosive storage and radioactive-source storage areas in the Reactor Maintenance Facility (Building 6593). An existing shop (Building 6591) would also be used as a staff shop (see Figure 3-7).

3.3.4.2 Annual Operations

The operational characteristics of the facilities under the SNL/NM Alternative, common to all alternatives, are provided in Section 3.2.

3.3.4.3 Construction Requirements

Table 3–7 shows the construction requirement parameters used in this environmental impact analysis.

Table 3–7 Construction Requirements under the SNL/NM Alternative

Requirement	*Quantity*
Electrical energy (megawatt hours)	170
Peak electrical demand (megawatts)	0.1
Concrete (cubic meters)	15,324
Steel (metric tons)	842
Fuel/gasoline (liters)	(a)
Water (liters)	22,700,000
Land (hectares)	1.82
Construction workers	
Total (during construction)	400
Peak	300
Construction time (months)	16

[a] Not provided. Considered to be part of construction costs; contractors to provide fuel/gasoline needed for their machinery.
Source: SNL/NM 2001b.

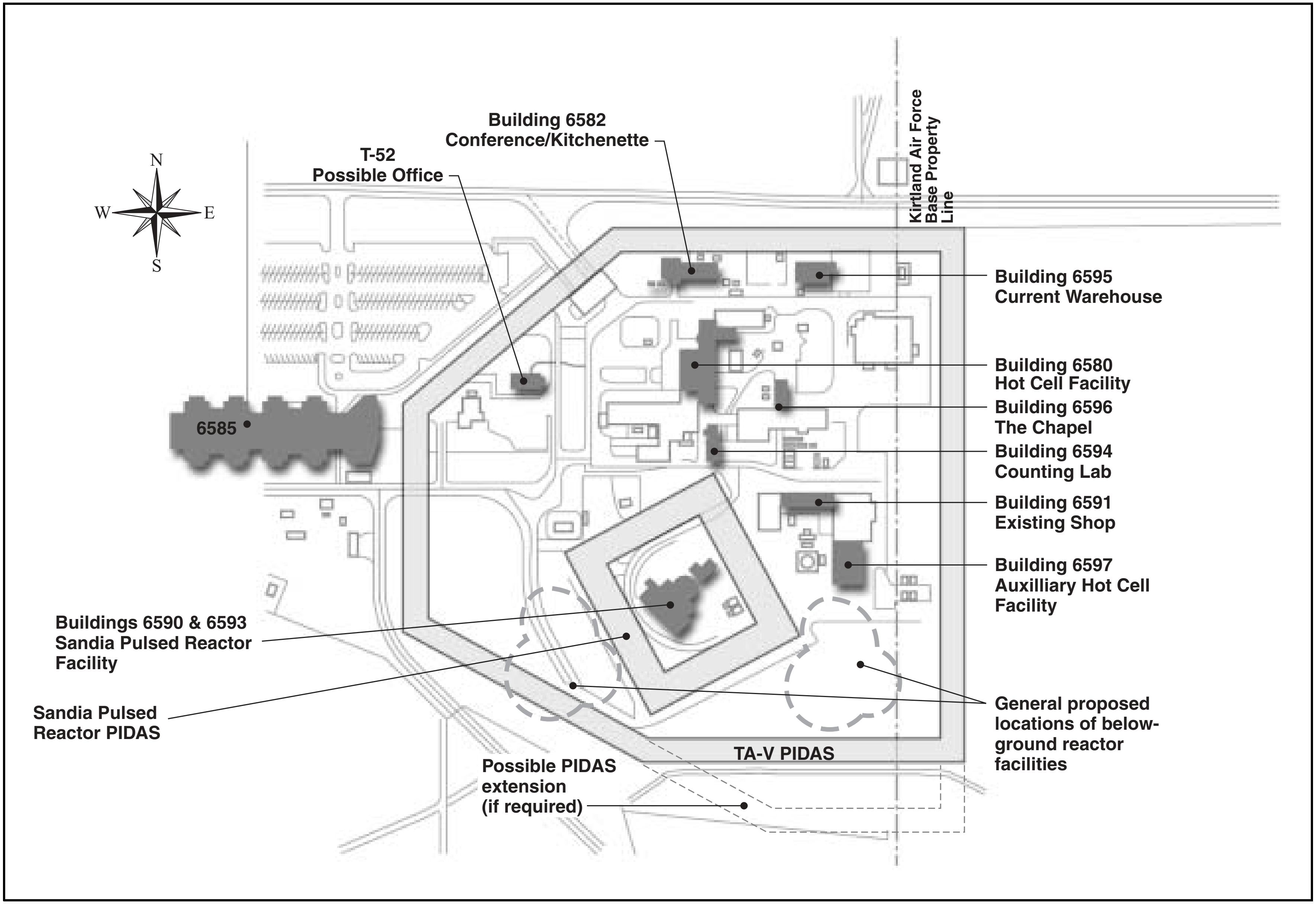

Figure 3–7 Proposed New SNL/NM Facility and Existing Facilities (SNL/NM Alternative)

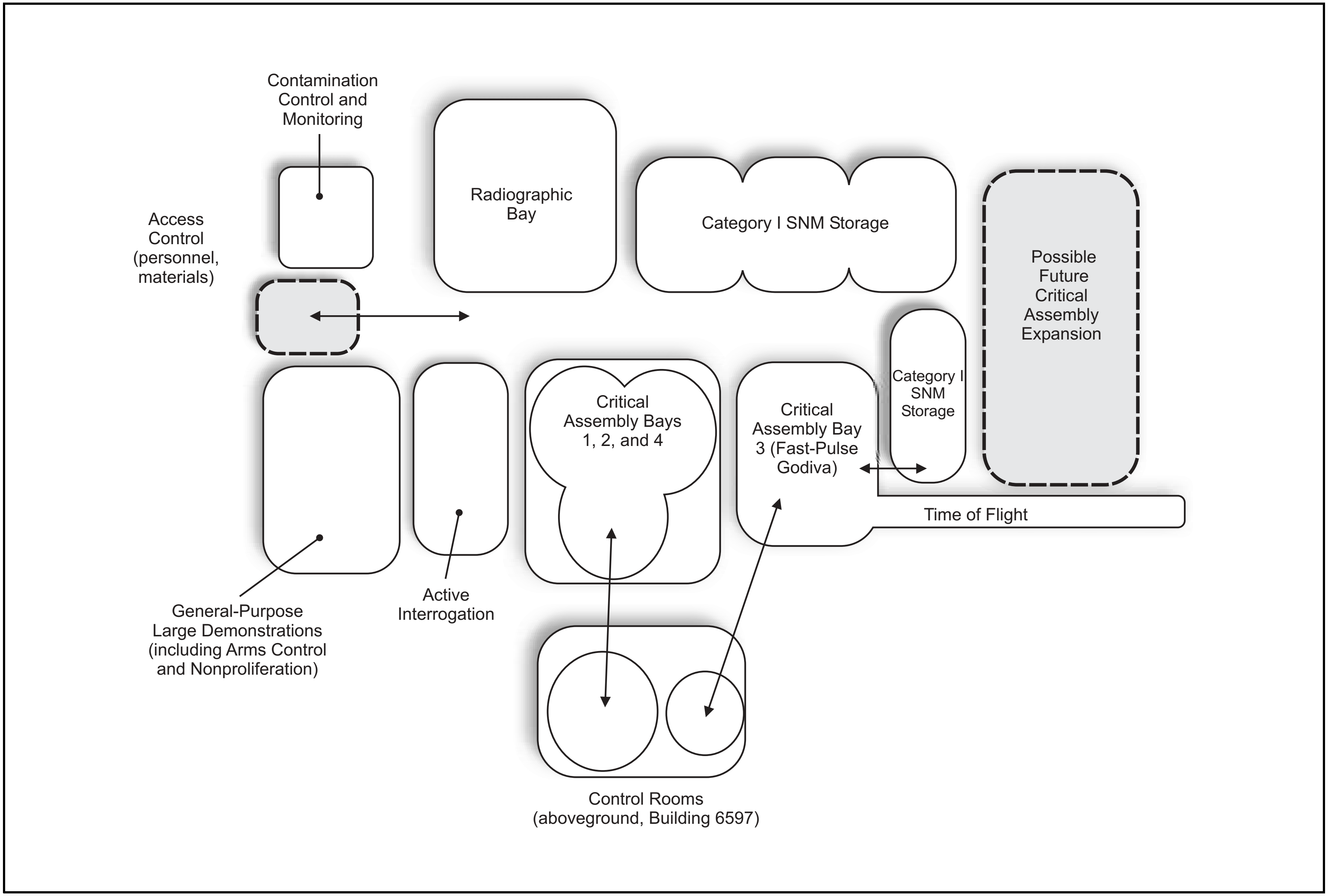

Figure 3–8 Schematic of the Underground Facility (SNL/NM Alternative)

3.3.5 NTS Alternative

This alternative would involve housing the TA-18 operational capabilities and materials associated with security Category I/II activities in and around the existing DAF at NTS. For this purpose, DAF would be modified internally to accommodate the critical assembly machines, control rooms, and SNM vaults, and two new buildings would be constructed external to the DAF security perimeter. The two new buildings would be a "low-scatter" facility to house emergency response activities with minimal reflection and a new administration building to accommodate a DAF Central Command Station and increased staffing associated with the TA-18 security Category I/II missions (NTS 2001). Under this alternative, a portion of the security Category III/IV activities (the SHEBA activities) would either be relocated to a new structure at LANL's TA-39 or remain at TA-18. The rest of the security Category III/IV activities would remain at TA-18. The relocation of SHEBA and other security Category III/IV activities to new structures at LANL is discussed in Section 5.6.

3.3.5.1 Facilities

Device Assembly Facility

DAF is a 9,290-square-meter (100,000-square-foot) nuclear explosive facility within a 12-hectare (29-acre) high-security area, located in Area 6 of DOE's NTS (see **Figure 3–9**). Construction on DAF began in the mid-1980s, when nuclear weapons testing was still in progress. DAF's original purpose was to consolidate all nuclear explosive assembly functions and to provide safe structures for high-explosive and nuclear explosive assembly operations, as well as a state-of-the-art safeguards and security environment.

Figure 3–9 DAF at NTS

DAF has five assembly cells, four high bays, three assembly bays, two radiography bays, five staging bays, a component testing laboratory, two shipping and receiving buildings, two decontamination facilities, three small vaults, an administration building, alarm stations, an entry guard station, and a mechanical and electrical support building (see **Figure 3–10**).

The main facility is covered with a minimum of 1.5 meters (5 feet) of earth. The major operating facilities, assembly cells and high bays, radiography bays, and shipping and receiving building have bridge cranes. Each assembly cell is designed and tested to undergo an explosion from a maximum high-explosive device without injury to personnel in an adjacent blast-protected area outside of the cell. Gravel covers are designed to minimize release of nuclear material in the unlikely event of an accidental explosion.

One face of DAF is exposed and opens onto the area enclosed within a PIDAS security fence. DAF has a comprehensive security system designed into the structure.

The TA-18 security Category I/II operational activities would occur in the west side of Building 400. The building east of Building 400 is currently nonoperational and kept in “ready-reserve” status. The current missions in this building would be relocated to the east side of the building. **Figures 3–11** and **3–12** show the proposed changes to accommodate the TA-18 activities.

The Building 370 corridor would remain in its present configuration with no equipment located within the corridor. The corridor is an unoccupied area, with administratively controlled access during normal operations.

A DAF Central Control Station would be placed in Building 400, allowing a readout of building status; fire and radiation alarm annunciation; weather reports on lightning; intercom and closed-circuit television control; and status of the individual heating, ventilating, and air conditioning systems.

Modifications inside DAF would include:

- Local modifications to internal walls, floors, and ceilings
- Local additions of bulk and penetration-shielding materials
- Local demolition of fire-suppression and other water systems
- Removal of polar cranes from assembly cells
- Raceway additions connecting the critical assemblies to their control rooms and power supplies
- Implementation of a DAF Central Control Station
- A new line-of-sight corridor internal to DAF

Buildings 302, 310, 332, and 352 would be used to house the critical assembly machines and associated control areas. Buildings 492 and 494 would be used for SNM storage.

New Low-Scatter Building

Because DAF is designed for blast protection, the buildings are constructed using massive concrete and steel surrounded by earthen fill. This is not compatible with one TA-18 activity that requires low reflectance from the surrounding walls, ceiling, and floor. The only acceptable way to meet this requirement would be to place this activity outside of DAF in a new “thin-skin,” or “low-scatter,” building. This low-scatter building would consist of a thin metal building and basement to prevent floor and wall radiation scatter. The low-scatter building would be placed in a location outside the DAF PIDAS.

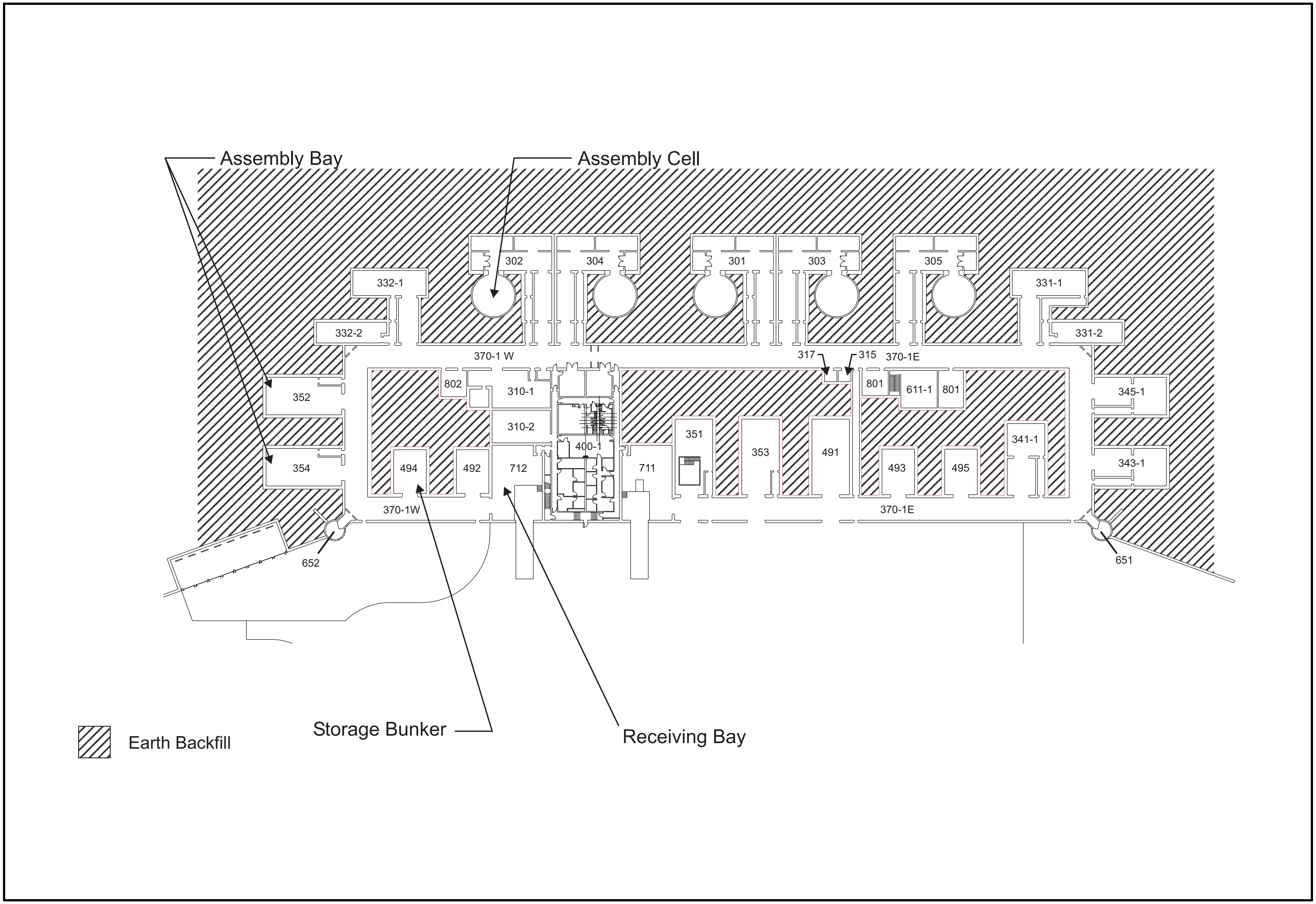

Figure 3–10 DAF Floor Plan

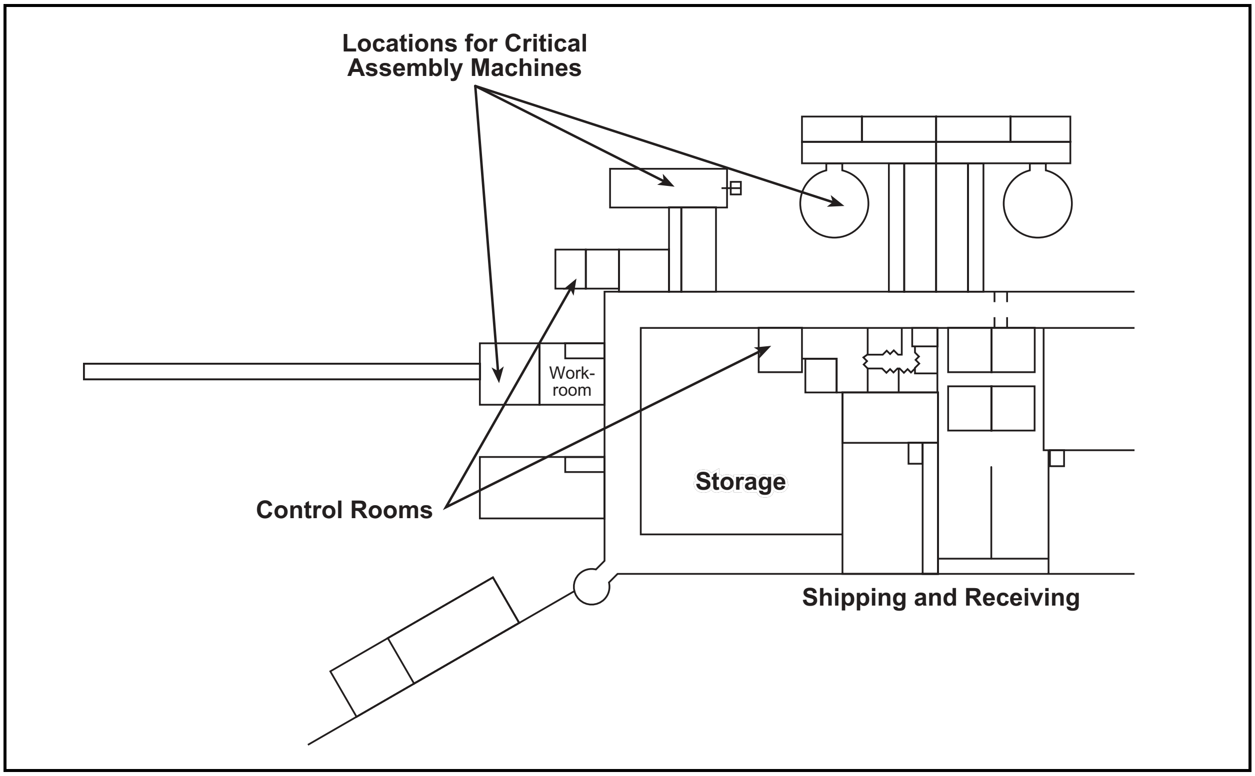

Figure 3–11 DAF Critical Assembly Layout

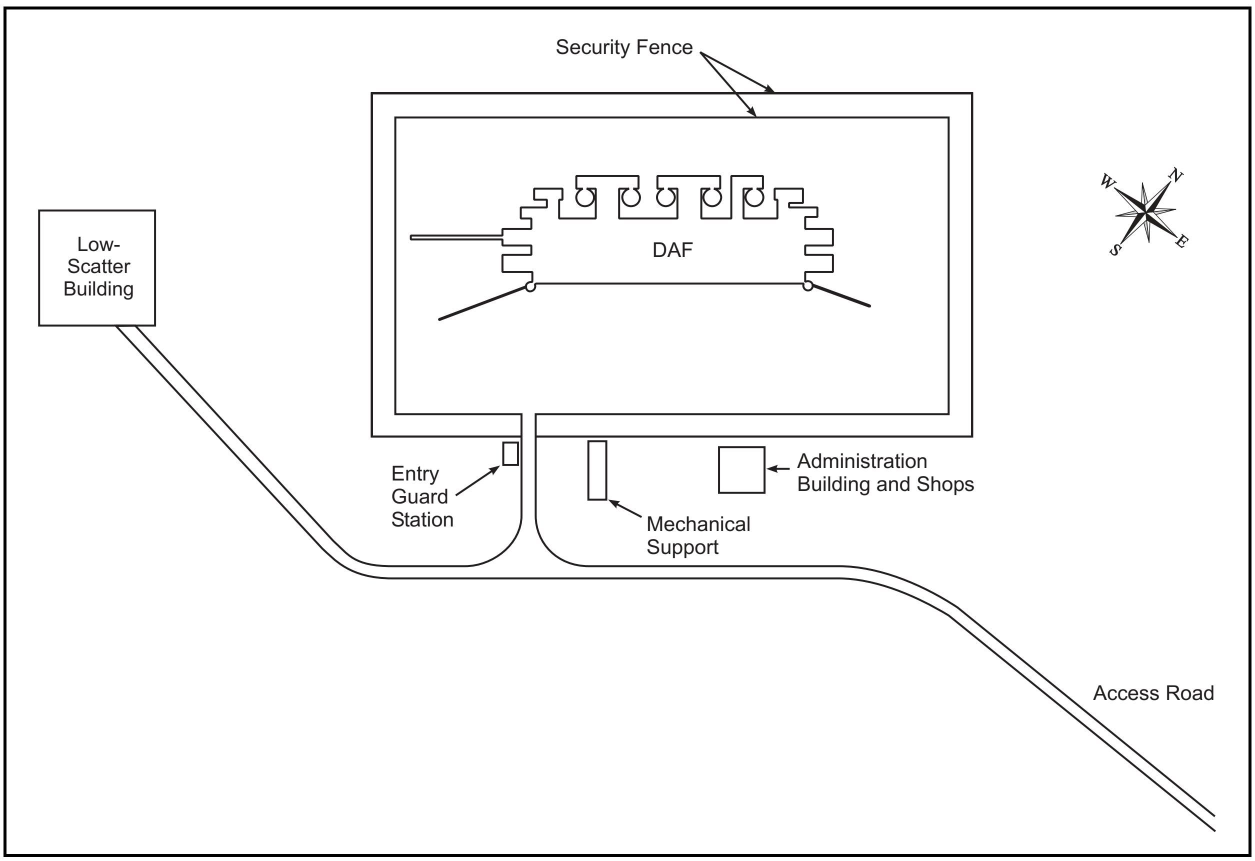

Figure 3–12 DAF Layout Site Vicinity

The TA-18 radiography function would be accommodated in the existing DAF radiography building.

New Administration Building

The personnel currently in Building 400 would be displaced to allow room for the DAF Central Control Station, Radiation Control Technician work area, Hot Work Laboratory, Document Control Center, and a screening entrance to the Material Accountability Area boundary. This displacement of personnel would require a new Administrative Building outside the PIDAS. The new 1,115-square-meter (12,000-square-foot) facility would house personnel, provide conference facilities, allow space for storage of materials, and house emergency response equipment.

3.3.5.2 Annual Operations

The operational characteristics of the facilities under the NTS Alternative, common to all alternatives, are provided in Section 3.2.

3.3.5.3 Construction Requirements

Table 3–8 shows the construction requirement parameters used in the environmental impacts analysis.

Table 3–8 Construction Requirements under the NTS Alternative

Requirement	*Quantity*
Electrical energy (megawatt hours)	16 [a]
Peak electrical demand (megawatts)	0.08
Concrete (cubic meters)	288
Steel (metric tons)	(b)
Fuel/gasoline (liters)	(b)
Water (liters)	3,980,000
Land (hectares)	3.64
Construction workers	
Total (during construction)	45
Peak	60
Construction time (months)	9

[a] Electric usage outside the DAF building.
[b] Not provided. Considered to be part of construction costs; contractors to provide steel for the construction and fuel/gasoline needed for their machinery.
Source: NTS 2001.

3.3.6 ANL-W Alternative

This alternative would involve the housing of TA-18 operational capabilities and materials associated with security Category I/II activities in buildings located at ANL-W. The facilities proposed for the relocation of security Category I/II activities are: FMF, with a proposed addition; the Zero Power Physics Reactor (ZPPR) facility; the Experimental Breeder Reactor II (EBR-II) containment and power plant; the Transient Reactor Test (TREAT) facility; and a new General-Purpose Experimental Building (GPEB) (ANL-W 2001). The site plan is shown in **Figure 3–13.** Under this alternative, a portion of the security Category III/IV activities (the SHEBA activities) would either be relocated to a new structure at LANL's TA-39 or remain at TA-18. The rest of the security Category III/IV activities would remain at TA-18. The relocation of SHEBA and other security Category III/IV activities to new structures at LANL is discussed in Section 5.6.

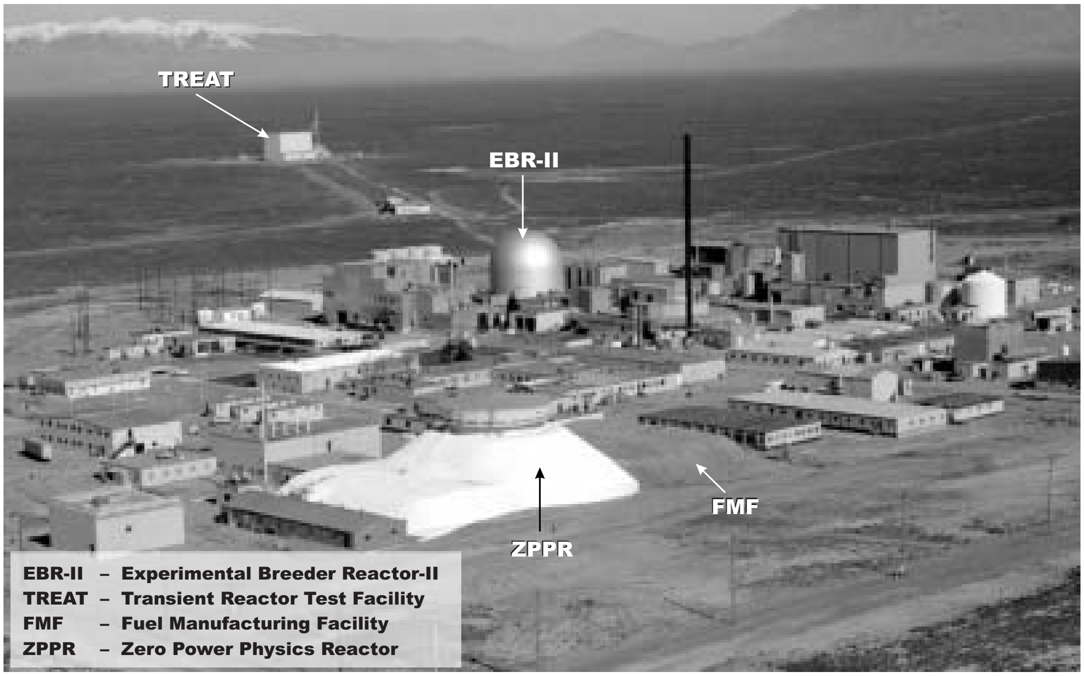

Figure 3–13 ANL-W Site

One critical assembly machine would be housed in the ZPPR cell with the control room collocated with the ZPPR control room. The control rooms would be located in the ZPPR support wing (Building 774), inside the protected area. Three other critical assemblies would be located in a new addition to FMF (Building 704). Control rooms would be located in the basement of the ZPPR support wing (Building 774), which is outside of the protected area (see **Figure 3–14**).

The EBR-II containment building would be used for radiography equipment. The truck lock located in the EBR-II power plant would be used for the emergency response staging area.

The low-scatter facility would be located on either the turbine floor of the EBR-II Power Plant (Building 768) or at the north end of the TREAT Reactor Building (Building 720).

Storage vault space requirements for security Category IB SNM would be provided in four different vaults within the protected area. Two of the vaults currently exist, while the other two would be constructed along with the new additions.

3.3.6.1 Facilities

Fuel Manufacturing Facility

FMF (Building 704) is located adjacent to the ZPPR facility (see **Figure 3–15**) and is covered with an earthen mound. FMF was used to manufacture fuel for EBR-II. The facility was completed in 1986 and was oversized for the EBR-II mission. The building includes a large SNM vault, an induction furnace, and gloveboxes and hoods, as well as other temporary experimental setups.

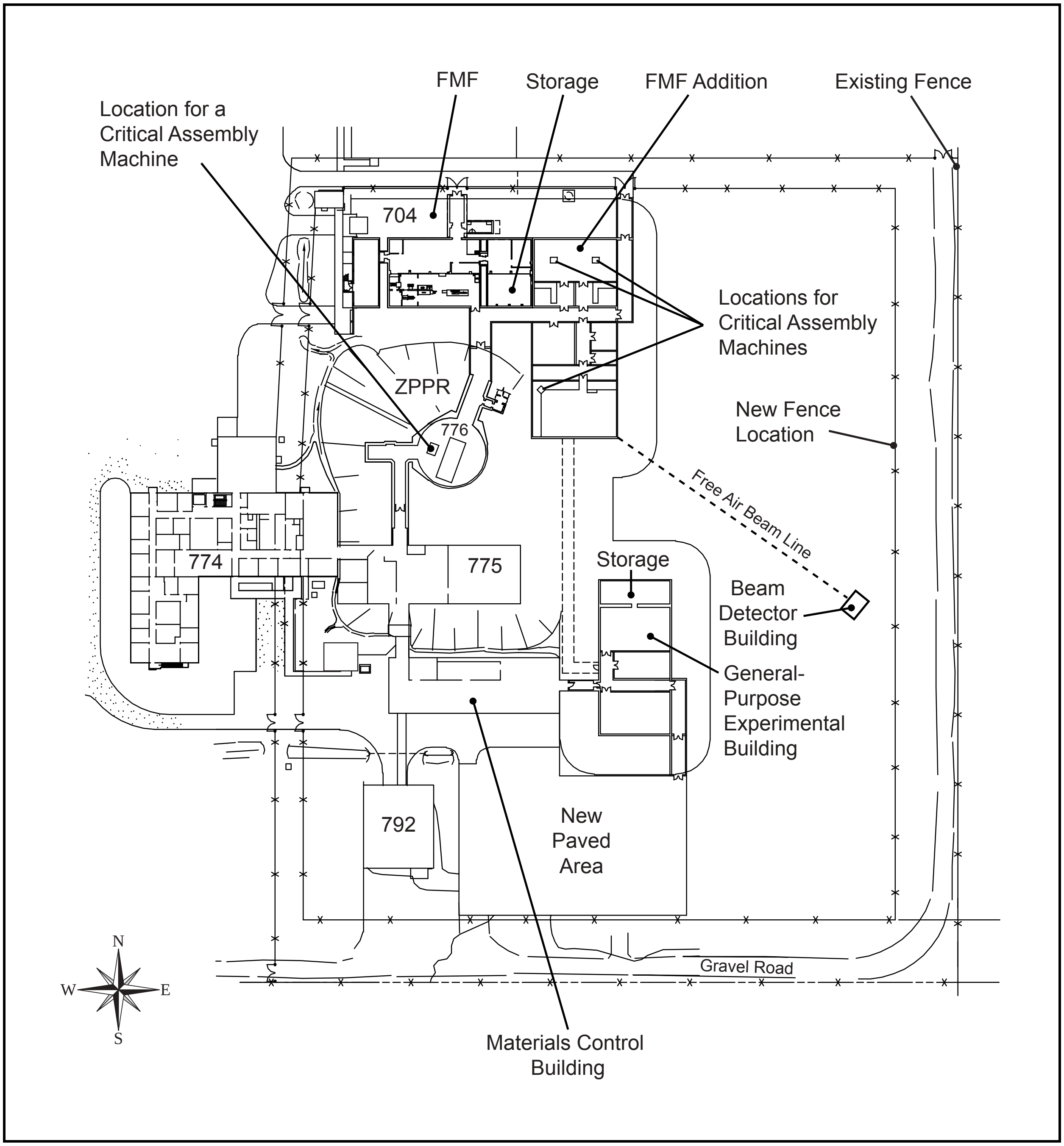

Figure 3–14 Proposed Relocation Layout (ANL-W Alternative)

Zero Power Physics Reactor

One critical assembly machine would be located in the reactor cell room of ZPPR (Building 776). It would share floor space in the reactor cell room with the existing ZPPR matrix. The material and equipment staging area for the machine would be located in Room 144 of Building 776, which is an alcove to the west of the reactor cell room. Space for instrumentation would be located in the workroom in Building 775.

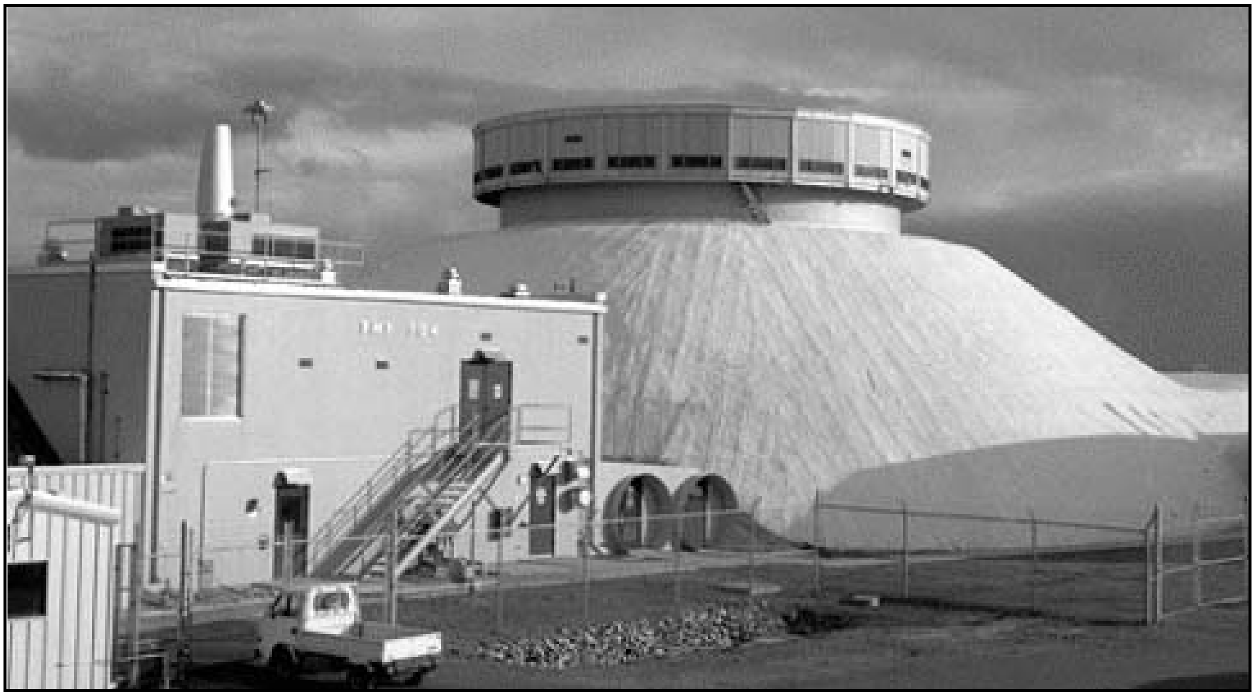

Figure 3–15 FMF and ZPPR Facilities

The ZPPR facility was built to allow the mock-up of full-sized breeder reactor cores using critical assemblies with full plutonium loadings. The facility includes a refined "Gravel Gertie" building, a type of construction originally designed for handling nuclear weapons. The principal experimental area has a very thick foundation and thick concrete walls covered with an earthen mound and a sand/gravel/high-efficiency particulate air filter roof. In addition to being explosion-resistant, the facility was designed to safely contain a fire involving a full breeder reactor core loaded with more than 2.7 metric tons (3 tons) of plutonium.

The ZPPR vault is located in Building 775, which is just south of the Building 776 ZPPR reactor cell within the protected area. ZPPR is currently in a nonoperational standby status. The ZPPR fuel inventory remains on the ANL-W site, and the ZPPR vault/workroom remains operational to support nuclear materials storage in the ZPPR vault. The stainless steel matrix and the support structure that make up the core, i.e., the critical assembly structure, remain in the reactor cell and are essentially uncontaminated and inactivated.

Experimental Breeder Reactor-II

The EBR-II containment building (Building 767) would be used for locating radiography equipment. The EBR-II facility is shown in **Figure 3–16**.

Transient Reactor Test Facility

Two locations have been identified that would be suitable for the low-scatter facility. One location is on the third floor of the power plant building, and the second is in the north end of the TREAT reactor building (Building 720). The TREAT facility is shown in **Figure 3–17**. A removable, elevated catwalk would need to be constructed for this purpose.

Figure 3–16 EBR-II Facility

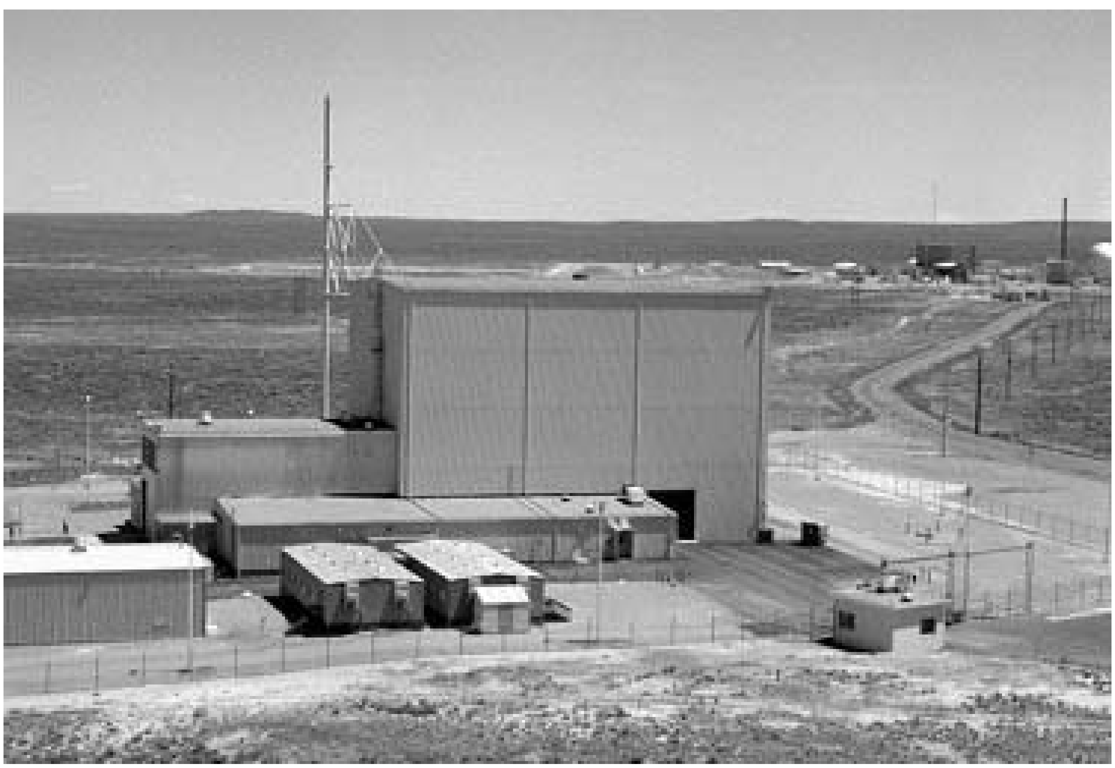

Figure 3–17 TREAT Facility

TREAT is an air-cooled, thermal heterogeneous test facility designed to evaluate reactor fuel and structural materials under conditions simulating various types of transient overpower and undercooling situations in a nuclear reactor. The TREAT complex comprises reactor and control buildings located within a mile to the northwest of the main ANL-W protected area at the ANL-W site. The TREAT facility is located within its own security Category II protected area. To better accommodate program activities temporarily performed in the building, the TREAT protected area is currently administered as security Category III, but authorization for security Category II operation remains.

New General-Purpose Experimental Building

To support detector development, research and development, training, and technology demonstrations, a new security Category I GPEB would be constructed. GPEB would be located next to the Materials Control Building (Building 784), with a new paved area to support material transportation vehicles (see Figure 3–14). Additional vault space for large items would be provided in GPEB.

New FMF Addition

An addition to FMF would be constructed to locate three of the critical assemblies (see Figure 3–14). The FMF addition would use the same beamed structural design as FMF. The facility structure, as well as the ventilation, would constitute the confinement system of the FMF addition.

The FMF addition would have exterior dimensions of 44 meters (145 feet) long (north-south) and 19 meters (62 feet) wide (east-west). The facility would be accessed by a new access tunnel starting from the ZPPR reactor cell and traveling to the west side of the addition. An escape tunnel would be located on the east side of the facility leading to a grated area. Security doors would be installed in the new tunnel extension from ZPPR and the escape tunnel.

3.3.6.2 Annual Operations

The operational characteristics of the facilities under the ANL-W Alternative, common to all alternatives, are provided in Section 3.2.

3.3.6.3 Construction Requirements

Table 3–9 shows the construction requirement parameters used in the environmental impacts analysis.

3.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

3.4.1 Discontinue TA-18 Missions

As explained in Chapter 2, the operations conducted at TA-18 are vital for DOE's mission requirements and must be maintained. This determination is consistent with independent reviews made by the Defense Nuclear Facilities Safety Board. In separate 1993 and 1997 studies of the TA-18 missions (DNFSB 1993, DNFSB 1997), the Defense Nuclear Facilities Safety Board recommended that DOE continue to maintain the capability to support the only remaining criticality safety program in the Nation. Few or none of DOE's nuclear programs could ensure their safe execution without the continued training, expertise, and calibration experiments that are available at a general-purpose criticality experiments facility. This alternative did not meet DOE's need for action and was not further analyzed in this EIS.

Table 3–9 Construction Requirements under the ANL-W Alternative

Requirement	*Quantity*
Electrical energy (megawatt hours)	26.2
Peak electrical demand (megawatts)	0.033
Concrete (cubic meters)	7,301
Steel (metric tons)	675
Fuel/gasoline (liters)	(a)
Water (liters)	97,300
Land (hectares)	0.62
Construction workers	
Total (during construction)	104
Peak	120
Construction time (months)	24

[a] Considered to be part of construction costs; contractors to provide fuel/gasoline needed for their machinery.
Source: ANL-W 2001.

3.4.2 Alternative Sites

As explained in Section 3.2.2, during the initial screening process, all DOE sites were considered for the relocation of TA-18 operational capabilities and materials. The DOE sites that did not pass the screening criteria were Rocky Flats, Hanford, the Idaho National Engineering and Environmental Laboratory, and Brookhaven National Laboratory. In addition to the DOE sites, possible relocation to Department of Defense installations was considered. However, there were serious concerns regarding long-term mission compatibility and security Category I requirements; therefore, Department of Defense sites were removed from further consideration for this EIS.

All DOE sites that passed the initial screening criteria were sent a request for additional site information. Five sites—Pantex (Amarillo, Texas), the Y-12 Plant (Oak Ridge, Tennessee), Oak Ridge National Laboratory (Oak Ridge, Tennessee), the Savannah River Site (Aiken, South Carolina), and Lawrence Livermore National Laboratory (Livermore, California)—were eliminated from further consideration because they did not meet the minimum site selection criteria requirements.

The potential use of the existing Nuclear Materials Storage Facility (NMSF) at TA-55 at LANL was evaluated for partial fulfillment of the TA-18 Relocation Project requirements. The evaluation included consideration of the use of NMSF for three critical assembly machines (excluding Godiva) and existing tunnels or other NMSF spaces for nuclear material storage. It was concluded that the TA-18 missions would not fit well into the NMSF and its use would still require a new building to be constructed. Such a proposal would require increased capital and operational costs.

3.5 COMPARISON OF ALTERNATIVES

3.5.1 Introduction

To aid the reader in understanding the differences among the various alternatives, this section presents a summary comparison of the potential environmental impacts associated with the alternatives for the relocation of the TA-18 operational capabilities and materials. The comparisons concentrate on those resources with the greatest potential to be impacted.

The information in this section is based on the descriptions of each alternative presented earlier in this chapter and the potential environmental consequences (presented in Chapter 5). Because the potential environmental impacts associated with each of the alternatives can be described in terms of *construction impacts* and *operations impacts*, the potential impacts are compared in those two areas. **Table 3–10** at the end of this chapter provides quantitative information that supports the text below. Table 3-10 also includes the environmental impacts associated with the potential relocation of the SHEBA activities and other security Category III/IV activities to new structures at LANL (see the last two columns of the table). These impacts should be considered in conjunction with the impacts involving the relocation of the TA-18 security Category I/II activities if SHEBA and other security Category III/IV activities do not remain at TA-18.

3.5.2 Construction Impacts

No Action Alternative—Under the No Action Alternative, as described in Section 3.3.1, there would be no new construction or upgrades. Accordingly, there would be no potential environmental impacts resulting from construction for this alternative.

TA-18 Upgrade Alternative—Under the TA-18 Upgrade Alternative, as described in Section 3.3.2, there would be minor construction impacts associated with upgrading the existing infrastructure and security at TA-18 to bring them into compliance with new and more stringent safety, security, and environmental standards. While most of the construction impacts would involve internal modifications to existing facilities, several new support facilities would be constructed, disturbing approximately 0.2 hectares (0.5 acres) of previously cleared land. The existing infrastructure would adequately support construction activities. Construction activities would result in potential temporary increases in air quality impacts, but these would be below ambient air quality standards. Construction activities would likely result in no or minor impacts on water, visual resources, biotic resources (including threatened and endangered species), geology and soils, or cultural and paleontological resources. The socioeconomic impacts associated with construction would not cause any major changes to employment, housing, or public finance in the socioeconomic region of influence. Waste generated during construction would be adequately managed by the existing LANL waste management infrastructure.

LANL New Facility Alternative—The construction of new security Category I/II buildings at LANL's TA-55, as described in Section 3.3.3, would disturb approximately 1.8 hectares (4.5 acres) of land, but would not change the area's current land-use designation. The existing infrastructure would adequately support construction activities. Construction activities would result in temporary increases in air quality impacts, but would be below ambient air quality standards, except for short-term concentrations of total suspended particulates at TA-55. Construction activities would not significantly impact water, visual resources, biotic resources (including threatened and endangered species), geology and soils, or cultural and paleontological resources. The socioeconomic impacts associated with construction would not cause any major changes to employment, housing, or public finance in the socioeconomic region of influence. Waste generated during construction would be adequately managed by the existing LANL waste management infrastructure.

SNL/NM Alternative—The relocation of the TA-18 capabilities and materials associated with security Category I/II activities to SNL/NM, as described in Section 3.3.4, would use 10 existing facilities, while also constructing a new, underground facility at TA-V. Approximately 1.8 hectares (4.5 acres) of land would be disturbed during construction of the new underground facility. The existing infrastructure would adequately support construction activities. Because the area was disturbed during previous construction activities at TA-V, further land disturbance is not expected to result in significant impacts on air, water, visual resources, biotic resources (including threatened and endangered species), geology and soils, or cultural and paleontological resources. The TA-18 operations would not change the area's current land-use designation. The socioeconomic impacts associated with construction would not cause any major changes to employment, housing, or public finance in the socioeconomic region of influence. Waste generated during construction would be adequately managed by the existing SNL/NM waste management infrastructure.

NTS Alternative— The relocation of the TA-18 capabilities and materials associated with security Category I/II activities to NTS, as described in Section 3.3.5, would entail upgrading DAF and constructing a new low-scatter building adjacent to DAF, as well as a new administration building. Approximately 0.9 hectares (2.2 acres) of land would be disturbed. Because NTS is such a large, remote site, and because the area was disturbed previously during construction activities associated with DAF, further land disturbance would likely result in no or minor impacts on air, water, visual resources, biotic resources (including threatened and endangered species), geology and soils, or cultural and paleontological resources. The TA-18 operations would not change the area's current land-use designation. The socioeconomic impacts associated with construction would not cause any major changes to employment, housing, or public finance in the socioeconomic region of influence. Waste generated during construction would be adequately managed by the existing NTS waste management infrastructure.

ANL-West Alternative—The relocation of the TA-18 operational capabilities and materials associated with security Category I/II activities to ANL-W, as described in Section 3.3.6, would entail the use of existing buildings and the construction of a new security Category I experimental building, an addition to FMF, and a tunnel to the existing ZPPR building. Approximately 0.6 hectares (1.5 acres) of land would be disturbed during construction activities. The existing infrastructure would adequately support construction activities. Because the area was disturbed during previous construction activities, further land disturbance would likely result in no or minor impacts on air, water, visual resources, biotic resources (including threatened and endangered species), geology and soils, or cultural and paleontological resources. The TA-18 operations would not change the area's current land-use designation. The socioeconomic impacts associated with construction would not cause any major changes to employment, housing, or public finance in the socioeconomic region of influence. Waste generated during construction would be adequately managed by the existing ANL-W waste management infrastructure.

3.5.3 Operations Impacts

TA-18 capabilities and materials relocated to any of the alternative sites would use similar facilities, procedures, resources, and numbers of workers during operations. As such, similar infrastructure support would be needed, similar emissions and waste would be produced, and similar impacts on workers would occur. For each alternative, the proposed construction or modification of buildings, structures, and infrastructure is slightly different, as is the environmental setting. These site differences would lead to some differences in environmental impacts based on the same operations. For most environmental areas of concern, however, these differences would be minor. It is not expected that there would be any perceivable operations impact differences among the alternatives on air, water, visual resources, biotic resources (including threatened and endangered species), geology and soils, cultural and paleontological resources, power usage, socioeconomics, or worker risks. Additionally, all alternatives have adequate existing waste management facilities to treat, store, and/or dispose of waste that would be generated by these operations. For all alternative sites, all impacts would be within regulated limits and would comply with Federal, state, and local requirements.

Normal operations under all alternatives would reduce radiological impacts as compared to the existing TA-18 operations. There would be small differences in potential radiological impacts on the public among the site alternatives. However, for all site alternatives, public radiation exposure would be small and well below regulatory limits and limits imposed by DOE orders. For all sites, the maximally exposed offsite individual would receive less than 0.067 millirem per year from the normal operational activities at TA-18. Statistically, this translates into a risk that one additional fatal cancer would occur approximately every 29 million years due to these operations. Doses from SHEBA operations account for 90 percent of the calculated dose at LANL. The operational impacts at SNL/NM, NTS, and ANL-W would be significantly smaller because of lower radioactive releases and specifically remoteness of the latter two sites, leading to lower public radiation exposure. At all sites, the total dose to the population within 80 kilometers (50 miles) would be a maximum of 0.10 person-rem per year from normal operational activities at TA-18. Statistically, this would equate to one additional fatal cancer every 20,000 years. Again, doses from SHEBA operations account for 90 percent of the calculated dose at LANL. Further, due to the remoteness of NTS and ANL-W, and the fact that these sites have the smallest 50-mile-radius populations, the 50-mile-radius population dose would be the least at these sites.

Potential impacts from accidents were estimated using computer modeling. In the event of an accident involving the operational activities, the projected latent cancer fatalities at all relocation sites would be significantly less than 1. For the bounding accident analyzed in the EIS, the highest potential annual risk to the population within 80 kilometers (50 miles) from the TA-18 operations activities would be an increase in latent cancer fatalities of 5.1×10^{-5} from a potential hydrogen detonation accident at SHEBA. Statistically, this would equate to 1 additional latent cancer fatality among the affected population every 19,600 years of operation. Overall, the No Action Alternative, and specifically SHEBA operations, would produce the highest potential accident impact, primarily due to the fact that existing TA-18 facilities do not incorporate high-efficiency particulate air filtration, and, in the case of SHEBA, the design provides minimal containment.

3.5.4 Transportation Risks

Except for the No Action Alternative and the TA-18 Upgrade Alternative, all other site alternatives would require the transportation of equipment and materials. Such transportation would involve the relocation of approximately 2.4 metric tons (2.6 tons) of SNM, as well as approximately 10 metric tons (11 tons) of equipment, some of which would be radioactively contaminated. For all alternatives, the environmental impacts and potential risks of such transportation would be small. For all alternatives, the risks associated with radiological transportation would be less than one fatality per 10,000 years under normal and accident conditions. Although the potential risks would differ among the alternatives primarily as a function of the transportation distance, the impacts would be very small. Based on distance, the ANL-W Alternative would have the highest potential impact, the NTS Alternative the second-highest, the SNL/NM Alternative the third-highest, and the LANL New Facility Alternative the least risk (compared to the No Action and TA-18 Upgrade Alternatives).

3.5.5 Relocation of SHEBA and Other Security Category III/IV Activities

Relocation of SHEBA activities to TA-39 would entail the disturbance of approximately 0.08 hectares (0.2 acres) on a 1.6-hectare (4-acre) parcel of land for the construction of new buildings. Water main and utility lines would follow roadways to the new structures. Relocation of security Category III/IV activities to TA-55 would entail the disturbance of approximately 1.6 hectares (4 acres) on a 3.2-hectare (8-acre) parcel of land.

At either TA-55 or TA-39, the construction activities would not change the current land-use designation. The existing infrastructure would adequately support construction activities. Construction activities would result in temporary increases in air quality impacts, but would be below ambient air quality standards, except for short-term concentrations of total suspended particulates at TA-55. Construction activities would not significantly impact water, visual resources, biotic resources (including threatened and endangered species), geology and soils, or cultural and paleontological resources. The socioeconomic impacts associated with construction would not cause any major changes to the regional economic area employment, housing, or public finance. Waste generated during construction would be adequately managed by the existing LANL waste management infrastructure.

SHEBA operations at TA-39 would not have any significant impact on air, water, visual resources, biotic resources (including threatened and endangered species), geology and soils, cultural and paleontological resources, power usage, socioeconomics, or worker risks. All impacts would be within regulated limits and would comply with Federal, state, and local requirements. During SHEBA operations, approximately 100 curies of argon-41 per year would be released to the environment. This would result in a dose of 0.061 millirem to the maximally exposed member of the public, which is well below the limit of 10 millirem per year set by both the U.S. Environmental Protection Agency and DOE for airborne releases of radioactivity. For the bounding accident analyzed in the EIS, the highest potential annual risk to the population within 80 kilometers (50 miles) from the TA-18 operational activities would be an increase in latent cancer fatalities of 4.9×10^{-5} from a potential hydrogen detonation accident at SHEBA. Statistically, this would equate to 1 additional latent cancer fatality every 20,400 years of operation. The existing waste management facilities at LANL would be adequate to treat, store, and/or dispose of waste that would be generated by this mission.

3.5.6 Impacts Common to All Alternatives

Critical Assembly Machine Refurbishment. One impact that would be common to all alternatives under the proposed action is the one-time generation of approximately 1.5 cubic meters (2 cubic yards) of low-level and mixed low-level radioactive waste from the refurbishment of the criticality machines currently housed at TA-18. The radioactive waste would consist of old electrical racks, hydraulic systems, control cartridges, and machine stands that would be replaced by new components as part of TA-18 mission relocation activities. The refurbishment of these criticality machines would occur under any of the proposed alternatives. Disposition of the radioactive and nonradioactive waste would be in accordance with established procedures. The impact of managing this waste would be minimal given the available site capacity at LANL (see Section 4.2.12).

Decontamination and Decommissioning. All alternatives would require some level of decontamination and decommissioning. Operations experience with TA-18 critical assembly machines has shown that, although some surface contamination may result from the conduct of specific criticality experiments, the nature and magnitude of this contamination is such that it can be easily removed and reduced to acceptable levels. Consequently, impacts associated with decontamination and decommissioning are expected to be limited to waste created that is within LANL's and other alternative sites' waste management capabilities. This, therefore, would not be a discriminating factor among the alternatives.

Decontamination and decommissioning at TA-18 would also involve environmental restoration activities to reduce the long-term public and worker health and safety risks associated with potentially contaminated areas within the site or with surplus facilities and to reduce the risk posed to ecosystems. Decisions regarding whether and how to undertake environmental restoration action would be made after a detailed assessment of the short- and long-term risks and benefits within the framework of the Resource Conservation and Recovery Act (RCRA). The approach for controlling the consequences of environmental restoration activities at LANL is summarized in the *LANL SWEIS* (DOE 1999b). Decontamination and decommissioning of TA-18 would involve the general types of activities described and analyzed in the *LANL SWEIS* (e.g., generation of low-level radioactive waste). Specific alternatives to be considered in the decontamination and decommissioning process would likely follow the RCRA framework and will be subject to project-specific National Environmental Policy Act (NEPA) analysis.

Table 3–10 Summary of Environmental Impacts for the Relocation of TA-18 Capabilities and Materials

Resource/Material Categories	*No Action Alternative*		*TA-18 Upgrade Alternative*		*LANL New Facility Alternative*		*SNL/NM Alternative*	
Land Resource								
- Construction/Operations	No impact		0.2 hectares/no impact		1.8 hectares/no impact		1.8 hectares/no impact	
Air Quality								
- Construction	No impact		Small temporary impact		Small temporary impact		Small temporary impact	
- Operations	110 curies per year of argon-41 released		110 curies per year of argon-41 released		10 curies per year of argon-41 released		10 curies per year of argon-41 released	
Water Resource								
- Construction	No impact		Small temporary impact		Small temporary impact		Small temporary impact	
- Operations	Small impact		Small impact		Small impact		Small impact	
Socioeconomics								
- Construction	No noticeable changes; No impact		No noticeable changes; 100 workers (peak); 422 jobs		No noticeable changes; 300 workers (peak); 1,152 jobs		No noticeable changes; 300 workers (peak)	
- Operations	No increase in workforce		No increase in workforce		No increase in workforce		20 people relocated or new hires	
Public and Occupational Health and Safety								
Normal Operations	***Dose***	***LCF***	***Dose***	***LCF***	***Dose***	***LCF***	***Dose***	***LCF***
- Population dose (person-rem per year)	0.10	0.00005	0.10	0.00005	0.011	5.5×10^{-6}	0.020	0.00001
- MEI (millirem per year)	0.067	3.4×10^{-8}	0.067	3.4×10^{-8}	0.0025	1.3×10^{-9}	0.00032	1.6×10^{-10}
- Average individual dose (millirem per year)	0.00030	1.5×10^{-10}	0.00030	1.5×10^{-10}	0.00004	2×10^{-11}	0.000027	1.3×10^{-11}
- Total worker dose (person-rem per year)	21	0.0085	21	0.0085	10 [b]	0.0040	10 [b]	0.0040
- Average worker dose (millirem per year)	100	0.00004	100	0.00004	100	0.00004	100	0.00004
Hazardous Chemicals	None		None		None		None	
Accidents (Maximum Annual Cancer Risk, LCF)								
- Population	5.1×10^{-5}		5.1×10^{-5}		9.1×10^{-8}		2.2×10^{-7}	
- MEI	1.7×10^{-7}		1.7×10^{-7}		6.1×10^{-11}		1.7×10^{-11}	
- Noninvolved worker	2.0×10^{-6}		2.0×10^{-6}		2.8×10^{-9}		2.8×10^{-9}	
Chemical Accidents	None							
Environmental Justice	No disproportionally high and adverse impacts on minority or low-income populations							
Waste Management (cubic meters of solid waste per year): Waste would be disposed of properly with small impact								
- Low-level radioactive waste [d]	145		145		145		145	
- Mixed low-level radioactive waste [d]	1.5		1.5		1.5		1.5	
- Hazardous waste	4		4		4		4	
Transportation								
- Incident-free	***Person-rem***	***LCF***	***Person-rem***	***LCF***	***Person-rem***	***LCF***	***Person-rem***	***LCF***
- Population	(f)	(f)	(f)	(f)	(f)	(f)	0.040	0.000020
- Workers	(f)	(f)	(f)	(f)	(f)	(f)	0.025	0.000010
Accidents								
- Population	(f)	(f)	(f)	(f)	(f)	(f)	7.0×10^{-6}	3.5×10^{-9}

LCF = latent cancer fatality; MEI = maximally exposed individual.

[a] Impacts to be considered in conjunction with the relocation of security Category I/II capabilities and materials if the security Category III/IV activities do not remain at TA-18.

[b] There would be an additional one-time dose to the workers of 2.3 person-rem from handling activities of the SNM that would be transported from TA-18 to the alternative site.

[c] There would be an additional one-time dose to workers of 0.02 person-rem from handling activities of materials associated with SHEBA operations.

NTS Alternative		***ANL-W Alternative***		***SHEBA Relocation to TA-39*** [a]		***Other Security Category III/IV Relocation to TA-55*** [a]	
0.9 hectares/no impact		0.6 hectares/no impact		0.5 hectares/no impact		1.7 hectares/no impact	
Small temporary impact		Small temporary impact		Small temporary impact		Small temporary impact	
10 curies per year of argon-41 released		10 curies per year of argon-41 released		100 curies per year of argon-41 released		Trace level of radioactivity released	
Small temporary impact		Small temporary impact		Small temporary impact		Small temporary impact	
Small impact		Small impact		Small impact		Small impact	
No noticeable changes; 60 workers (peak)		No noticeable changes; 120 workers (peak)		No noticeable changes; 25 workers (peak)		No noticeable changes; 45 workers (peak)	
20 people relocated or new hires		20 people relocated or new hires		No increase in workforce		No increase in workforce	
Dose	***LCF***	***Dose***	***LCF***	***Dose***	***LCF***	***Dose***	***LCF***
0.000070	3.5×10^{-8}	0.00041	2.1×10^{-7}	0.087	0.000044	Small	
0.000087	4.4×10^{-11}	0.00021	1.1×10^{-10}	0.061	3.0×10^{-8}	Small	
3.9×10^{-6}	1.9×10^{-12}	1.7×10^{-6}	8.6×10^{-13}	0.00019	1.0×10^{-10}	Small	
10 [b]	0.0040	10 [b]	0.0040	11 [c]	0.0045	Small	
100	0.00004	100	0.00004	100	0.00004	Small	
None		None		None		None	
7.7×10^{-10}		7.7×10^{-9}		4.9×10^{-5}		Small	
2.5×10^{-12}		7.3×10^{-12}		1.4×10^{-7}		Small	
4.0×10^{-9}		7.2×10^{-9}		2.0×10^{-6}		Small	
None							
No disproportionally high and adverse impacts on minority or low-income populations							
145		145		(e)		(e)	
1.5		1.5		(e)		(e)	
4		4		(e)		(e)	
Person-rem	***LCF***	***Person-rem***	***LCF***	***Person-rem***	***LCF***	***Person-rem***	***LCF***
0.33	0.00016	0.39	0.00019	(f)	(f)	(f)	(f)
0.25	0.00010	0.28	0.00011	(f)	(f)	(f)	(f)
0.000028	1.4×10^{-8}	0.000038	1.9×10^{-8}	(f)	(f)	(f)	(f)

[d] There would be a one-time generation of 1.5 cubic meters of low-level radioactive and mixed low-level radioactive waste at LANL from the refurbishment of the critical assembly machines.

[e] Waste generation from SHEBA, security Category III/IV, and security Category I/II activities would be similar to those generated under the No Action Alternative.

[f] LANL intrasite SNM and material transportation impacts would be bounded by the normal operation and accident impacts evaluated for the various LANL alternatives.

3.6 PREFERRED ALTERNATIVE

The Council on Environmental Quality regulations require an agency to identify its preferred alternative, if one or more exists, in the draft EIS (40 CFR 1502.14(e)). The preferred alterative is the alternative which the agency believes would fulfill its statutory mission, giving consideration to environmental, economic, technical, and other factors. When the former Secretary of Energy announced that DOE would prepare this *TA-18 Relocation EIS*, it was also announced that a new location at LANL to conduct the TA-18 operations and store associated materials was the Preferred Alternative (the LANL New Facility Alternative). Since publication of the TA-18 Relocation Draft EIS, NNSA has conducted additional analyses and has concluded that relocating the security Category I/II activities to NTS is the Preferred Alternative. The conclusion was based on cost, security, and mission factors. The Preferred Alternative for SHEBA and other security Category III/IV activities is that those activities remain at TA-18.